वार्षिक प्रतिवेदन
ANNUAL REPORT
2022










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

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.

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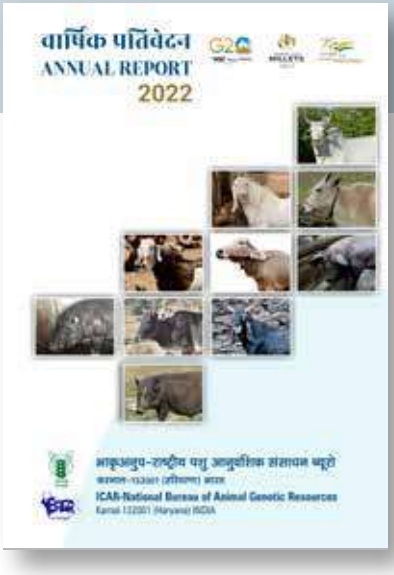

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From the Director's Desk

I am delighted to present the "Annual Report - 2022" of the ICAR-National Bureau of Animal Genetic Resources (NBAGR) to our esteemed readers. This report highlights the exceptional achievements of ICAR-NBAGR throughout the year, as we have remained committed to our scientific pursuits in the identification, characterization, conservation, evaluation, and sustainable utilization of Animal Genetic Resources (AnGR).
It is with great pride that we share our efforts to document and preserve the diverse AnGR biodiversity in India.

The year 2022 holds special significance for us, as we actively engaged in the "Mission towards Zero Non-descript AnGR of India," launched in August 2021. This mission has provided us with a solid foundation to describe the vast livestock and poultry diversity across the country. We have indicated countrywide surveys in collaboration with State AHDs, SAUs, SVUs, and stakeholders, marching steadily towards characterization of non-descript AnGR. Our dedicated team of scientists has organized interface meetings with state animal husbandry departments and universities to sensitize them about native AnGR and devise strategies for their documentation. Through field surveys, we have identified many prospective populations that are currently undergoing characterization. Witnessing our progress, we are confident in achieving our envisioned goals.

In 2022, we successfully registered ten new breeds of indigenous livestock species in the country, including Kathani cattle of Maharashtra, Sanchori cattle of Rajasthan, Masilum cattle of Meghalaya, Purnathadi buffalo of Maharashtra, Sojat, Karauli, and Gujari goats of Rajasthan, Banda pig of Jharkhand, Manipuri Black pig of Manipur, and WakChambil pig of Meghalaya. These new additions have elevated the total number of registered indigenous breeds to 212, encompassing various species ranging from cattle, buffalo, goat, and sheep to horses & ponies, camel, pig, donkey, dog, yak, chicken, duck, and geese.

Throughout the year, ICAR-NBAGR organized seven Interface Meets for Telangana, Punjab, Haryana, Madhya Pradesh, West Bengal, Himachal Pradesh, and Bihar states. In Collaboration with SAHD, KVKs, and SAUs/SVUs, we conducted surveys in 14 states, including Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhattisgarh, Odisha, Tamil Nadu, Maharashtra, Bihar, Arunachal Pradesh, Mizoram, Nagaland, Sikkim, Meghalaya, and Ladakh (UT). Under exploring and identifying new homogenous populations of livestock, poultry, and dogs, our efforts have resulted in the identification of 24 new potential populations within the country. Furthermore, in collaboration with state agencies, the Bureau was in process of characterization work for ten new populations from six states and one UT, which included the Native Lahuri goat and Dang sheep of the Chambal region in Madhya Pradesh, Sikkimese yak of Sikkim, Combai dog of Tamil Nadu, Changkhi dog of Ladakh, Mahi cattle, and Vagadi goat of Rajasthan,

Sarguja goat of Chattisgarh, Masilum cattle and Wakchambil pig of Meghalaya.

Our research endeavors in the trait characterization of native germplasm using molecular approaches have notable achievements which include identifying metabole signatures in the colostrum and milk of Ladakhi cattle adapted to high altitudes and elucidating biological processes contributing to melanogenesis and cellular adaptive mechanisms in Kadaknath chicken. Research work also carried out for exploring genomic diversity in Indian sheep and goats, identifying genomic signatures in Changthangi goat, characterizing milk exosomes in cattle, and understanding the molecular basis of seasonal variation in seminal attributes in buffalo bulls. Additionally, we are actively working on developing methods to optimize genomic selection through different algorithms, assessing population uniformity using photographs, and conducting admixture mapping of cattle.

To assess the risk status of indigenous breeds, the Bureau introduced the Breed Watchlist-2022, serving as a valuable indicator for prioritizing the conservation and efficient management of AnGR. Our commitment to cryopreserving semen, somatic cells, and DNA is a testament to our dedication to fulfilling the UN's Sustainable Development Goal 2. Out of a total of 38 indigenous breeds at risk, we have successfully cryopreserved nineteen at the National gene bank of the institute.

Our research activities have gained significant momentum through 35 institutional projects and six externally funded projects, all meticulously screened by the Institute Research Committee, Research Advisory Committee, and external funding agencies. I extend my best wishes to all the scientists and research scholars of the institute for their research publications in esteemed national and international journals, as well as their recognitions at various scientific platforms.

The "Breed Conservation Awards-2022," honoring individuals and institutes for their exceptional contributions to conserving the animal genetic resources of the country, have gained nationwide attention and appreciation. Throughout the year, we celebrated our foundation day and organized the National Conference of SOCDAB, witnessed the participation of over 300 delegates. Additionally, we conducted a five-day training program on Capacity Building of Field Veterinary Officers on the Management of Indigenous Domestic Animal Diversity, with 52 participants from 15 states. Interactive meeting with the Animal Husbandry Statistics Division, DAHD, were also conducted to discuss technical modalities for conducting the Breed-wise Livestock Census at national level. I extend my congratulations to all the scientists, technical, administrative, and other staff members of the institute for their remarkable contributions to the progress of the Bureau and their personal and professional achievements. Words of encouragement and appreciation from esteemed visitors have consistently motivated the Bureau staff to strive for excellence and fulfill the entrusted mandate. I express my heartfelt gratitude to Dr. Himanshu Pathak, Secretary DARE and DG, ICAR, for his continuous motivation and insightful guidance. I also acknowledge the cooperation and guidance received from Dr. B N Tripathi, DDG (AS) ICAR, and Dr. P K Rout, ADG (AP&B) ICAR in all the activities of the Bureau.

I sincerely hope that the "Annual Report 2022" of ICAR-NBAGR will serve as a valuable source of information for all custodians of AnGR in the country. We welcome suggestions for further improvement as we strive to advance our mission.

Jai Hind !

(BP Mishra)

निदेशक की कलम से...

मैं सम्मानित पाठकों के लिए भाकृअनुप - राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो की "वार्षिक रिपोर्ट - 2022" प्रस्तुत करते हुए प्रसन्नता की अनुभूति कर रहा हूँ। यह रिपोर्ट पूरे वर्ष संस्थान की महत्वपूर्ण एवं उत्कृष्ट उपलब्धियों पर प्रकाश डालती है। हमारा संस्थान पशुधन आनुवंशिक संसाधनों (एएनजीआर) की पहचान, लक्षण वर्णन, संरक्षण, मूल्यांकन और उनके सतत उपयोग में अपनी वैज्ञानिक गतिविधियों के लिए प्रतिबद्ध है। यह गर्व की बात है कि हम भारत में विविध एएनजीआर जैव विविधता का दस्तावेजीकरण और संरक्षण करने के अपने प्रयासों को आपसे साझा कर रहे हैं।

वर्ष 2022 हमारे लिए विशेष महत्व रखता है, क्योंकि इस वर्ष अगस्त 2021 में शुरू किए गए "शून्य गैर-वर्णनात्मक एएनजीआर के मिशन" में हमारा संस्थान सक्रिय रूप से काम कर रहा है। इस मिशन ने हमें देश की विशाल पशुधन और पोल्ट्री विविधता का वर्णन करने के लिए एक ठोस आधार प्रदान किया है। संस्थान ने राज्य पशुपालन विभागों, राज्य कृषि/पशु चिकित्सा वि वि, गैर सरकारी संगठनों एवं हितधारकों के सहयोग से देशव्यापी सर्वेक्षण आरम्भ किया है, जो शून्य गैर-वर्णनात्मक एएनजीआर के हमारे लक्ष्य की ओर तीव्रता से आगे बढ़ रहा है। संस्थान के वैज्ञानिकों की समर्पित टीम ने राज्य के पशुपालन विभागों और कृषि/पशु चिकित्सा विश्वविद्यालयों को देशी एएनजीआर के बारे में जागरूक करने और उनके दस्तावेज़ीकरण के लिए रणनीति तैयार करने के लिए उनके साथ इंटरफ़ेस बैठकें आयोजित की हैं। क्षेत्रीय सर्वेक्षणों के माध्यम से, हमने कई संभावित नई पशु आबादी की पहचान की है जो वर्तमान में लक्षण वर्णन के दौर से गुजर रही हैं। प्रगति को देखते हुए, हम अपने निर्धारित लक्ष्यों को प्राप्त करने के लिए पूर्ण रूप से आश्वस्त हैं।

वर्ष 2022 में, हमने देश में स्वदेशी पशुधन प्रजातियों की दस नई नस्लों को पंजीकृत किया है, जिनमें महाराष्ट्र का कथानी गोवंश, राजस्थान का सांचोरी गोवंश, मेघालय का मासिलुम गोवंश, महाराष्ट्र की पूर्णथाडी भैंस, राजस्थान की सोजत, करौली एवं गुजरी बकरियां, झारखंड की बांडा शूकर, मणिपुर की मणिपुरी ब्लैक शूकर एवं मेघालय की वाकचाम्बिल शूकर शामिल है। इससे हमारे देश में पंजीकृत स्वदेशी नस्लों की कुल संख्या 212 तक हो गयी है, जिसमें गोवंश, भैंस, बकरी और भेड़ से लेकर घोड़े एवं टट्टू, ऊंट, शूकर, गधा, श्वान, याक, मुर्गी, बत्तख और गीज़ तक की विभिन्न प्रजातियाँ शामिल हैं।

वर्ष के दौरान, भाकृअनुप – रा. प. आ. सं. ब्यूरो ने तेलंगाना, पंजाब, हरियाणा, मध्य प्रदेश, पश्चिम बंगाल, हिमाचल प्रदेश और बिहार राज्यों में सात इंटरफ़ेस बैठकें आयोजित की हैं। राज्य पशुपालन विभाग, कृषि विज्ञान केंद्र एवं पशुपालन विभागों और कृषि/पशु चिकित्सा विश्वविद्यालयों के सहयोग से, हिमाचल प्रदेश, उत्तर प्रदेश, मध्य प्रदेश, राजस्थान, छत्तीसगढ़, ओडिशा, तमिलनाडु, महाराष्ट्र, बिहार, अरुणाचल प्रदेश, मिजोरम, नागालैंड, सिक्किम, मेघालय और लद्दाख (केंद्र शासित) सहित 14 राज्यों में सर्वेक्षण किया गया है। मिशन के तहत देशी पशुधन, कुक्कुट एवं श्वान की नई आबादी की खोज एवं पहचान के लिए अबतक कुल 16 राज्यों और 1 केंद्र शासित प्रदेश में सर्वेक्षण किया गया है; परिणामस्वरूप देश में 24 नई संभावित पशु समूह की पहचान हुई है। इसके अलावा, राज्य एजेंसियों के सहयोग से, ब्यूरो ने छह राज्यों एवं एक केन्द्रशासित प्रदेश की दस नई आबादी के अध्ययन का काम पूर्ण कर लिया है, जिसमें मध्य प्रदेश के चंबल क्षेत्र की लाहुरी बकरी और डांग भेड़, सिक्किम के सिक्किमी याक, तमिलनाडु के कोम्बाई श्वान, लद्दाख का चांगखी श्वान एवं राजस्थान की माही गाय गोवंश एवं वागड़ी बकरी, छतीसगढ़ की सरगुजा बकरी, मेघालय का मासिलुम गोवंश एवं वाक चाम्बिल शूकर शामिल हैं।

संस्थान के शोध प्रयासों ने आणविक दृष्टिकोण का उपयोग करके देशी जर्मप्लाज्म के अध्ययन में महत्वपूर्ण सफलताएं हासिल की हैं। इन उल्लेखनीय उपलब्धियों में उच्च ऊंचाई के लिए अनुकूलित लद्दाखी गोवंश के कोलोस्ट्रम और दूध में मेटाबॉलिक हस्ताक्षर की पहचान करना, कड़कनाथ मुर्गी में मेलानोजेनेसिस एवं सेलुलर अनुकूली तंत्र में योगदान देने वाली जैविक प्रक्रियाओं को स्पष्ट करना आदि शामिल है। भारतीय भेड़ और बकरियों में जीनोमिक विविधता की खोज करना, चांगथांगी बकरी में जीनोमिक हस्ताक्षर की पहचान करने, गोवंश में दूध एक्सोसोम की विशेषता एवं भैंस बैल में वीर्य गुणों में मौसमी भिन्नता के आणविक आधार को समझने आदि पर अनुसंधान किया गया। इसके अतिरिक्त विभिन्न एल्गोरिदम के माध्यम से जीनोमिक चयन को अनुकूलित करने, चित्रों का प्रयोग करके पशु समूह की एकरूपता का आकलन करने और गोवंश के मिश्रण मानचित्रण का संचालन करने के तरीकों को विकसित करने पर भी सक्रिय रूप से कार्य हो रहा है।

स्वदेशी पशुधन नस्लों की जोखिम स्थिति का आकलन करने के लिए, ब्यूरो ने पशुधन निगरानी सूची (ब्रीड वॉचलिस्ट) - 2022 जारी की है, जो पशु आनुवंशिक संसाधनों के संरक्षण एवं कुशल प्रबंधन को प्राथमिकता देने के लिए एक मूल्यवान संकेतक का कार्य करती है। वीर्य, दैहिक कोशिकाओं और डीएनए को हिमीकृत करने की हमारी प्रतिबद्धता संयुक्त राष्ट्र के सतत विकास लक्ष्य 2 को पूरा करने के प्रति हमारे समर्पण का एक प्रमाण है। संख्या की दृष्टि से खतरे में पड़ी कुल 38 स्वदेशी नस्लों में से, संस्थान के राष्ट्रीय जीन बैंक में उन्नीस नस्लों को सफलतापूर्वक क्रायोप्रिजर्व किया गया है।

संस्थान की अनुसंधान गतिविधियां 35 संस्थागत परियोजनाओं एवं छह बाह्य वित्त पोषित परियोजनाओं के माध्यम से गतिशील हैं। सभी परियोनाओं की संस्थान अनुसंधान समिति, अनुसंधान सलाहकार समिति एवं बाहरी फंडिंग एजेंसियों द्वारा समय - समय पर प्रगति की समीक्षा भी गयी। मैं संस्थान के सभी वैज्ञानिकों एवं अनुसंधान वेत्ताओं को प्रतिष्ठित राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं में उनके शोध प्रकाशनों के साथ-साथ विभिन्न वैज्ञानिक प्लेटफार्मों पर उनके अनुसंधानों की सराहना एवं मान्यता के लिए शुभकामनाएं देता हूं।

देशी पशु आनुवंशिक संसाधनों के संरक्षण में योगदान के लिए दिए गए व्यक्तिगत एवं संस्थागत "नस्ल संरक्षण पुरस्कार-2022" ने देश भर में ध्यान आकर्षित किया और सराहना प्राप्त की है। वर्ष के दौरान संस्थान का स्थापना दिवस मनाया गया और सोसाएटी फॉर कंजर्वेशन ऑफ़ डोमेस्टिक एनिमल बायोडाइवर्सिटी का राष्ट्रीय सम्मेलन भी आयोजित किया गया जिसमें देश भर से 300 से अधिक प्रतिभागियों ने भागीदारी की। इसके अतिरिक्त, स्वदेशी घरेलू पशु विविधता के प्रबंधन पर प्रक्षेत्र पशु चिकित्सा अधिकारियों के क्षमता विकास पर पांच दिवसीय प्रशिक्षण कार्यक्रम भी आयोजित किया गया, जिसमें 15 राज्यों के 52 प्रतिभागियों ने भाग लिया। राष्ट्रीय स्तर पर नस्ल-वार पशुधन गणना के संचालन के लिए तकनीकी विधियों पर चर्चा करने के लिए सांख्यिकी प्रभाग, पशुपालन विभाग भारत सरकार के साथ इंटरैक्टिव बैठक भी आयोजित की गई। मैं संस्थान के सभी वैज्ञानिकों, तकनीकी, प्रशासनिक और अन्य कर्मचारियों को ब्यूरो की प्रगति में उनके उल्लेखनीय योगदान एवं उपलब्धियों के लिए बधाई देता हूं। वर्ष के दौरान संस्थान में पधारे विशिष्ट सम्मानित अतिथियों के प्रोत्साहन और प्रशंसा ने संस्थान के कर्मचारियों को उत्कृष्टता के लिए कार्य करने एवं सौंपे गए अधिदेश को पूरा करने के लिए लगातार प्रेरणा किया। मैं डॉ. हिमांशु पाठक, सचिव डेयर और महानिदेशक, भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली को उनकी निरंतर प्रेरणा एवं मार्गदर्शन के लिए हार्दिक आभार व्यक्त करता हूं। मैं ब्यूरो की सभी गतिविधियों में डॉ. बी एन त्रिपाठी, उप महानिदेशक (पशु विज्ञान) एवं डॉ. पी के राउत, सहायक महानिदेशक (पशु उत्पादन एवं प्रजनन) भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली से प्राप्त सहयोग और मार्गदर्शन के लिए भी आभार व्यक्त करता हूं।

मुझे पूरी उम्मीद है कि भाकृअनुप - राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो की "वार्षिक रिपोर्ट - 2022" स्वदेशी पशु आनुवंशिक संसाधनों के संरक्षण में लगे सभी व्यक्तियों एवं संस्थाओं के लिए एक मूल्यवान जानकारी के स्रोत के रूप में काम करेगी। मैं संस्थान के मिशन एवं अधिदेश को पूरा करने हेतु किये जा रहे प्रयासों एवं उनमें सुधार के लिए सुझावों का स्वागत करता हूँ।

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 2022, seven Interface Meets for Telangana, Punjab, Haryana, Madhya Pradesh, West Bengal, Himachal Pradesh, Bihar states have been organized. By the end of 2022, Interface Meets with 12 states and one UT has been competed under the mission.

After launch of the Mission, 17 institutional projects were initiated for survey and documentation of AnGR in various states in collaboration with SAHD, KVKs, SAUs/SVUs. These projects encompassed 22 States/UT of the country. After launch of the Mission, Bureau has been surveyed in 16 states & 1 UT to explore and identify new homogenous populations of livesotkck, poultry and dog. During 2022, surveys were conducted in 14 states - Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhattisgarh, Odisha, Tamil Nadu, Maharashtra, Bihar, Arunachal Pradesh, Mizoram, Nagaland, Sikkim, Meghalaya and Union Terriotry of Ladakh.

During 2022, thirteen new populations were identified in eight states - Lahuri goat and Dang sheep of Madhya Pradesh, Combai dog of Tamil

Nadu, Mahi cattlle and Vagadi goat of Rajasthan, Eki dog of Arunachal Pradesh, Battisi goat and Rampur Hound dog of Uttar Pradesh, Malkanagiri pony, Burudi and Gola pig of Odisha, Simanchal sheep and Sitamrhi goat of Bihar. All that exploration under the Mission has resulted in identification of 33 new populations.

Ten new populations belonging to seven states have been characterized under the Mission during 2022. These included -Native Lahuri goat and Dang sheep of Madhya Pradesh, Sikkimese yak of Sikkim, Combai dog of Tamil Nadu, Changkhi dog of Ladakh, Masilum cattle and Wak Chambil pig of Meghalaya, Sarguja goat of Chhattisgarh, Mahi cattlle and Vagadi goat of Rajasthan. Other populations are being further characterized by the Bureau in collaboration with state agencies.

Registration of animal breeds

Ten indigenous breeds of livestock belonging to five states were registered by ICAR-NBAGR in 2022. After including these breeds, total number of registered indigenous breeds has been reached to 212, including 53 for cattle, 20 for buffalo, 37 for goat, 44 for sheep, 7 for horses & ponies, 9 for camel, 13 for pig, 3 for donkey, 3 for dog, 1 for yak, 19 for chicken, 2 for duck and 1 for geese. A large number of livestock has been inducted in descript category. Registration of new breeds initiates various development programs and policy formation in the country. All these registeted breeds were also Gazette notified by the Govt. of India; which provided national sovereignty over native breeds. Brief discription of new breeds is as follows-

Purnathadi buffalo is distributed in Vidarbha region of Maharashtra state. It is medium in size with whitish to light brown coat. Leg extremities and tail switch are white. Horns are long with hook like appearance at end. Milk yield ranges from 353 to1533 kg in a lactation. Milk fat percentage ranges from 6.5 to11.5.

Kathani is a dual purpose cattle. It is distributed in mainly Vidarbha region of Western Maharashtra. The Kathani cattle possesses good draft ability, suited to marshy land for paddy cultivation.

Sanchori is a medium sized, good milk producing cattle. It is distributed in Jalore district of Rajasthan. Majority of animals are white in colour. Average daily milk yield is about 9 kg with 2769 kg milk in a lactation.

Masilum is a small sized but well-built and sturdy cattle of Meghalaya. It is well adapted to the hill ecosystem. These cattle are reared by the Khasi and Jaintia communities for sports, manure and socio-cultural festivals.

Sojat is a large sized dual purpose goat; reared for both meat and milk purpose. Sojat is mainly distributed in Pali, Jodhpur, Nagaur and Jaisalmer districts of Rajasthan. Average adult weight is about 60.0 kg in males. Average milk yield in female is about 1 kg per day.

Karauli is *a* medium to large sized goat, reared for meat and milk. It is distributed in Sawai Madhopur, Kota, Bundi, and Baran districts of Rajasthan. Average adult weight in males is about 52.0 kg. Average daily milk yield is 1.530 Kg.

Gujari goat is a large sized, dual-purpose breed of Rajasthan. Coat colour is mixed of brown and white with white face, leg and abdomen. Average adult weight is about 69.0 kg in males and 58.0 kg in females. Average daily milk yield is 1.616 Kg.

Banda pig is native of Jharkhand, mainly reared for pork and manure. Animals are black coloured, having short and erect ear. Average adult body weight is 28.0 kg in male and 27.0 kg in females. Litter size ranges from 4 to 7.

Manipuri Black is native pig of Manipur state, mainly reared for meat. Adult body weight averages about 96.0 kg in males and 93.0 kg in females. Litter size ranges from 6 to 11 at birth. Meat is preferred for its taste by local people.

Wak Chambil is a small sized pig with round and pendulous belly. It is mainly distributed in Garo Hills of Meghalaya. Pork is known for its unique flavour and cherished during ceremonial occasions. Average adult body weight is 32.0 kg in males. Litter size at birth ranges from 4 to11.

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 Masilum cattle of Meghalaya, native cattle of Udaipur region of Rajasthan, Lahuri goat of Madhya Pradesh, Malra goat of Ladakh, Sarguja goat of Chhattisgarh, Native goat of Udaipur region of Rajasthan, Dang sheep of Madhya Pradesh, Marluk sheep of Ladakh, Wak Chambil pig of Meghalaya, Chang-khi dog of Ladakh, Combai dog of Tamil Nadu was carried out. Populations like Masilum cattle and Wak Chambil pig have been completely characterized and registered. Characterization of many of new populations like Ruhelkhandi cattle of Uttar Pradesh, native cattle populations of Kerala and Tamil Nadu, Battisi goat of Uttar Pradesh, Eki dog of Arunachal Pradesh and Rampur Hound dog of Uttar Pradesh has also been initiated during this year. Documentation of native chicken of Tripura was also carried out. Summery of newly characterization populations is given below-

Masilum cattle (Hill cattle) is distributed in South West Khasi Hills, East Khasi Hills, Eastern-west Khasi Hills, West Khasi Hills, Ri-Bhoi, West Jaintia Hills and East Jaintia Hills districts of Meghalaya. The utility of the cattle is Sports (Bull fighting), beef production, manure and socio-cultural festivals. It is small sized, well built cattle. Body colour is black mainly. Masilum cattle have short leg, well-built hoof and suited for climbing hilly terrains and best fit for bull fighting thus popularly known as bull fighting cattle. Average height at wither are 112.6 and 110.9 cm in adult male and female, respectively. The average daily milk yield is 2.18 kg.

Native cattle (Mahi) of Udaipur division of Rajasthan are small-sized with light grey or grey coat and compact body. It possesses small hump, short neck, thin and short legs, straight face, small and straight forehead and prominent poll. Average height at withers in adult females and males 97.0±0.45 and 102.2±1.11 cm, respectively. Daily milk yield is 1-3 litres and milk fat content is 3-5%.

Lahuri goat population is distributed mainly in Sabalgarh area of Morena and Vijaipur, Birpur area of Sheopur districts of Chambal Division of Madhya Pradesh. These goats are adapted to Dang production system of the Chambal river ravines. In some of the region, the animals are reared under pastoral system along with Dang sheep. It is medium type goat with an elegant look. The coat colour of the goat is shiny red on the anterior side, shoulder and fore limb, transitioning to shiny brownish to blackish on the rear part of the body. Ears are exceptionally long in Lahuri goat, reaching upto 28 cm. Both sexes possess highly coiled horns. These goats are reared for meat purpose only.

Malra is a non-pashmina goat of Ladakh (UT). It is a medium to large size goat, reared for meat and manure in Khaltse, Lamayuru, Lingshet, Photoksar, Skiu, Markha, villages of Leh District and in adjacent places of Kargil district. Compact body is covered with hairs which gives advantage in harsh winter

climate of Ladakh. Ears are small in size and erect. Body is compact and covered with hairs. Live weight of buck ranges from is 18-45 kg and doe ranges from 15-30kg.

Sarguja is a homogenous goat population of Chhattisgarh. It is concentrated in Sarguja and adjoining districts. Coat colour is brown to dark brown in most of the animals. The population is having two distinct phenotypes based on coat colour and marking pattern. Average body height 66.5 and 63.4 cm in adult male and female, respectively.

Native goats of the Udaipur Division are small and either black or reddish-brown coat in appearance. Tufted hairs (black or brown) can be seen on the thighs. The medium-sized, drooping ears have a leaf-like appearance. 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. The females have medium conical teats and a small, pendulous udder. The mean values of body length, height at withers and chest girth for adult females are 58.6±0.31, 65.5±0.29 and 69.0±0.35cm, respectively. Average body weight of doe is 25.6±0.34 kg. Daily milk yield was 300-500 ml.

Dang sheep is distributed in Bhind, Morena and Sheopur districts of Chambal division of Madhya Pradesh, with high density in ravine (Dang) region of Chambal River. These sheep flocks are reared under pastoral system and graze in dry and arid highland ravines. The sheep are medium sized. Body colour is creamish white with brownish patches on face. Ears are leafy and folded from midline. Tail is medium in length, thick at origin and tapered at the end. The wool is of medium in thickness, dense, and slightly curly. Average adult weight in females was estimated to be 35.13 Kg. These sheep are mainly reared for meat production.

Malluk sheep is distributed in Lingshet, Photoksar, Skiu, Markha, Lamayuru, Khaltse and Hanu area of Leh district as well as some parts of Zanskar block in the Kargil district. Animals are small to medium in size, with long pointed flat head. The animals are known for their disease resistance, sturdiness, and prolificacy. Coat colour is white in majority of animals however, animals with shades of black are also present. Head and ears are usually brown with white patches on forehead. Body is covered with relatively fine fleece. Body length and Height at withers are 48.39±0.76 & 51.41±0.69 in female and 52.68±0.74, 55.62±0.69, in males, respectively.

Wak Chambil pigs are distributed in North Garo Hills, East Garo Hills, South Garo Hills, West Garo Hills and South West Garo Hills districts of Meghalaya. This is the smallest pig breed of India. Body colour black with white or grey patches at extremities. Snout is short and pointed. Ears are erect. Limbs are short. Pendulous belly resembling to Citrus macroptera fruit and short and high-dense bristles over the body are the unique feature. Pork has unique flavour and taste, making them popular during special religious and ceremonial occasions. Slaughter weight in males and females are 31.43 kg and 28.42 kg, respectively.

Survey was conducted to study the indigenous chicken population in West Tripura, Gomati, Sepahijala, Khowai and Dhalai districts in Tripura state. The native chickens are mostly raised under semi-intensive system of rearing. Plumage pattern in most of the birds are of spotted type with varying plumage colors. Annual egg production ranged from 40 to 45 eggs. Due to significant variation in phenotypes, these birds could not be categorized as a potential population.

Changkhi, as watch dog is reared by Changpa nomads of Changthang (Ladakh) to guard their livestock mainly Changthangi sheep and

Changthangi goat. Two types of coat colours were observed viz. one with complete fawn or light brown colour and animals with complete black coat with fawn or brown patches around eyes and face. This unique canine germplasm is an integral part of Changpa nomads.

Combai dogs are believed to be originated from a village called Combai in Theni district, however, fairly distributed throughout Tamil Nadu. They are predominantly kept as a guard dog for agriculture field and farm houses. The majority of Combai dogs have short coat with coat colour ranging from reddish brown colour to light brown with a black muzzle and nostrils. Ears are medium in size with most of the animals having drooping or semi-drooping ears. Tail is long, tapering and slightly curved at the distal end. They are known for alertness, high aggression and loyalty and kept for guarding agricultural farms and farmhouses.

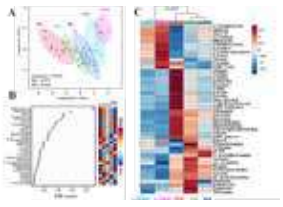
Assessment of livestock population uniformity is important aspect; use of Artificial Intelligence (AI) may help to address the issue. A project has been initiated to explore the methods of segmentation and phenotyping of animals from photographs. Model parameters are being fine-tuned. Animal photographs of cattle and sheep available in the AnGR database are being utilized as trial to segment the animal images.

A project for determining population composition of mixed non-descript cattle was initiated using SNP chip genotyping. A total of 192 DNA samples of 9 cattle populations were genotyped using GGP 50K SNP chip. Population structure using Principal component analysis (PCA) revealed clear difference between the cattle population of Bihar and Jharkhand region (Gangatiri, Bachaur, Purnea and Shahabadi) and those of Maharashtra (Khamgaon, nondescript, Gaolao) and crossbred.

Whole genome SNP based diversity was analysed in native goat breeds of the country. Indian goat breeds displayed 94% within breed diversity based on F_{ST} values. The breed specific SNPs and INDELs were most abundant in Kanni Adu, while lowest in Jharkhand Black. The increased breed diversity may be a result of high gene flow across breeds. Linkage Disequlibrium (LD) analysis revealed that LD decayed below 0.2 within 10kb distance for all breeds, except for Jharkhand Black, Sangamneri and Tellicherry. The results revealed that Jharkhand Black, Kanni Adu, Sangamneri and Tellicherry were very distinct from the other Indian breeds.

Complete mitochondrial genome sequences of 88 Indian sheep representing 22 breeds/populations were analyzed to get a comprehensive picture of the maternal diversity in the sheep genetic resources of India. Total 84 novel haplotypes were identified in Indian sheep, with an overall haplotype diversity (Hd) value of 0.999, and nucleotide diversity (π) equal to 0.00183. AMOVA analysis between the four separate clusters representing northern temperate, southern peninsular, eastern and north-western arid and semi-arid regions attributed maximum genetic variance within the clusters. Indian sheep showed conformity to haplogroups A and B reported across the world.

Three centres were initiated under Network Project: ICAR Research Complex of Eastern Region, Patna (Bihar); Maharashtra Animal & Fishery Science University, Nagpur (Maharashtra) and State Animal Husbandry Department, Arunachal Pradesh. The populations identified by the bureau in the region are being characterized in detail following systematic survey with standardized questionnaires.



Evaluation of native AnGR

Native cows of Ladakh are unique and well-adapted to high altitude hypobaric hypoxia conditions. Metabolome signature of Ladakhi cows and yak were

established. In Ladakhi cattle, total 46 metabolites from 8 different classes such as organic acids, amino acids, organic nitrogen compounds, Carbohydrates, Nucleic acids, Benzenoids, Fatty Acyls and; Organic oxygen compounds were detected using NMR spectroscopy. Among these, 31 metabolites showed significant differences ($p<0.01$) in their concentration across colostrum (0-day), transition (2-&4-day) and mature milk (<30-&>30-days). Several of the metabolites showed highest enrichment in colostrum (0-day) while their levels declined gradually in transition to mature milk samples. high level of branched chain amino acids -valine, leucine, isoleucine was observed in the colostrum of Ladakhi cows. The enrichment analysis identified top 25 metabolite encriched terms upon comparing the metabolome data of colostrum and mature milk. Such findings will be helpful in adding value to Ladakhi cow colostrum.

Metabolic profiles of various biofluids (serum, saliva, urine, feces) of Ladakhi were generated by ^{1}H-NMR. A total of 249 metabolites were identified across the five biological fluids. Out of these, only 8 metabolites were common across all biofluids. Rest of the metabolites were either present uniquely or partially overlapped across different biofluids.

Immunoglobulins (IgG1, IgA, IgM) and two major whey proteins with antimicrobial properties (Lactoferrin and Lysozyme) and growth factor (insulin growth factor) were estimated in colostrum, mature milk (60-90 days) in Ladakhi cattle and yak of Ladakh naturally adapted to hypobaric hypoxia condition, using bovine specific ELISA kits. The concentrations of IgG1, IgG2, IgA and IgM were found to be maximum in colostrum of Ladakhi cattle, yak vis-à-vis Sahiwal. Further, level declined substantially in mature milk samples (60-90 days) across the three animal types. Lysozyme concentration was also relatively high in colostrum samples and then slightly reduced in mature milk. In contrary, the lactoperoxidase level was high in mature milk as compared to colostrum across all the three populations.

The morphology of exosomes isolated from milk of indicus, taurine and cross bred cows was confirmed with TEM while size distribution and particle number was checked through nanoparticle tracking. Metabolome profiling revealed the presence of 41 different metabolites present in milk derived exosomes, out of which 23 were differentially regulated (≤0.05 p-value) across the Indicus, taurine and crossbred cows. Small RNA library has been prepared.

Differentially expressed genes identified in PBMCs of cattle infected with vector-borne haemoprotozoan diseases (theileriosis and anaplasmosis) were associated with immune system, cytokines and regulation of mitotic cycle while those in non-infected animals were related to histone deacetylases (HDACs), telomerase maintenance as well as nucleosome assembly. The enriched pathways and genes in healthy animals suggest maintenance of chromatin integrity.

RNA sequencing-based comparative expression analysis of pectoralis major muscles of black (Kadaknath) and white meat (broiler) birds revealed important genes and pathways linked to melanogenesis and cellular adaptation in Kadaknath and growth in broiler.

Using reduced representation bisulfite sequencing (RRBS) of spermatozoal genomic DNA of buffalo bulls, having varying semen quality due to heat stress, the spermatogenesis associated major genes with hypermethylated CpGs in the promoter and intergenic regions have been identified, playing important role in sperm function and semen quality. Mitochondrial copy number, analyzed in the spermatozoa cells of seasonally affected and

non-affected bulls was found to be without any significant variation. B2M and EEF2 have been identified as the most stably expressed internal housekeeping genes in buffalo bull's spermatozoa, for real-time PCR based gene expression analysis.

Accuracy of genomic prediction in livestock is influenced by SNP markers as well as the size of reference population. To maximize the accuracy of genomic selection, genetic algorithms (GA) was used to find subset of SNP markers that would enhance accuracy of genomic selection. The GA selected about half the SNP markers as well as animals to provide matching prediction accuracy of RR-BLUP with the full set. It provided higher prediction accuracy compared to those obtained using RR-BLUP for half the number of animals selected randomly from the training-set.

Cytogenetic screening was conducted for 205 cattle and buffalo kept for breeding purpose by 11 government agencies of three states. Total 5 cattle bulls were also screened for DNA testing for genetic diseases for BLAD, Citrullinemia Factor XI deficiency and DUMPS (HF and HF crosses only). A1A2 genotyping was carried out for 235 cattle.

Conservation of AnGR

ICAR-NBAGR is conserving indigenous breeds of livestock through cryopreserving the germplasm in its National Gene Bank. During 2022 is an outstanding year for cryopreservation of farm animal germplasm. This year, the germplasm of 29 indigenous breeds (30660 semen doses of 15 breeds and 1740 vials of somatic cells of 14 breeds) was cryopreserved at National Gene Bank. Further 95 oocytes (vitrified) of 5 native breeds- Changthangi, Bhakarwal goat, Gurej, Changthangi and Karnah sheep were also cryopreserved.

Presently, the germplasm of 59 indigenous livestock breeds in form of semen and 34 livestock breeds in form of somatic cells have been cryopreserved. The Bureau has cryopreserved the germplasm of the 19 indigenous breeds 'at risk' (50 percent of breeds at risk), in form of semen/somatic cells/ ova in its National Genebank. Besides preserving our precious biodiversity, also fulfils Sustainable Development Goal (SDG) Indicator 2.5.1.

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. 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.

Research projects and publications

The research endeavors of the bureau were accomplished under 29 institute projects, 5 externally funded projects and one IAEA International project. First International project on 'Delineating Genomic Diversity, Population Structure and Demographic Dynamics in Diverse Native Buffalo Breeds of India.' Funded by International Atomic Energy Agency (IAEA) was initiated in the Bureau.

39 research papers including 19 in International Journals were published by the scientists of the Bureau during year 2022.

Technology

First Examination Reports were filed for 4 patent applications on genome-wide QTLs in buffalo. SNP/ genotype data on indigenous cattle and buffalo breeds were transferred to NDDB to design a

combined SNP chip, to be used for genomic selection in the country. Data Transfer Agreement was also signed between the organization.

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.

Capacity building

Bureau organized online training on "Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity" (14-18 Nov, 2022). Total 52 Veterinarians of 18 states /UTs attended the training.

Bureau organized National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" (21-22 Sept, 2022), wherein about 300 delegates participated.

Farmers awareness programme

Bureau organized six SCSP Programs in Tripura, Sikkim & Haryana covering 240 beneficiaries. Set up 3 exhibitions (GADVASU Ludhiana, ICAR-SBI Karnal, ICAR-IIWBR Karnal). Organized 2 Farmers Awareness Program under Mera Gaon Mera Gaurav. Conducted 4 Vichar Goshthi & Awareness camp in Ladakh (UT) and 2 MGMG programs. Organized 3 scientific lectures on AnGR management by the eminent speakers under AKAM. Staff of the Bureau & other ICAR institutes, personeels from NGOs attend the program.

Celebrations

Kisan diwas was celebrated on 23 Dec 2022 and Breed Conservation Award-2022 conferred to 4 farmers and 8 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.

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

Two scientists joined the bureau during the year-2022.

Many distinguished personnel including Hon'ble Minister of Animal Husbandry, Govt. of Uttar Pradesh visited the Institute.

कार्यकारी सारांश

संस्थान की रुप रेखा

भाकृअनुप-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो (एनबीएजीआर), भारतीय कृषि अनुसंधान परिषद (भाकृअनुप) के तहत छह ब्यूरो में से एक है, जोकि वर्ष 1984 में स्वदेशी पशुधन संसाधनों उनके सतत उपयोग एवं उनकी देश के लोगों की आजीविका सुरक्षा में योगदान को दृष्टिगत रखते हुए उनकी संरक्षा एवं संरक्षण के मिशन हेतु, स्थापित किया गया है, इसका विशिष्ट अधिदेश है - 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 नए संभावित पशु समूहों का पता लगाने और उसका लक्षण वर्णन करने, इनका दस्तावेजीकरण करने और उसे पंजीकृत करने के लिए सर्वेक्षण करने सहित कई गतिविधियाँ हैं; जैसेकि सभी राज्यों को शामिल करते हुए स्वदेशी नस्लों की प्राथमिकता और संरक्षण, अद्वितीय लक्षणों की पहचान, उनका मूल्यांकन और उपयोग। ब्यूरो देश में नस्ल पंजीकरण के लिए नोडल एजेंसी का कार्य करती है। ब्यूरो द्वारा विकसित पशु नस्लों के पंजीकरण और राजपत्र अधिसूचना की रूपरेखा दुनिया में अद्वितीय है। देश के एक पशु ब्यूरो के रूप में, यह AnGR से संबंधित संयुक्त राष्ट्र के खाद्य एवं कृषि संगठन सहित विभिन्न राष्ट्रीय और अंतर्राष्ट्रीय एजेंसियों के साथ भी समन्वय करता है। यह संयुक्त राष्ट्र के सतत विकास लक्ष्य (एसडीजी) 2 संकेतक 2.5.1 और 2.5.2 के लिए एक नोडल एजेंसी भी है।

संस्थान के निर्धारित लक्ष्यों और उद्देश्यों को तीन स्थापित प्रभागों - 1) पशु जैव प्रौद्योगिकी, 2) पशु आनुवंशिकी, और 3) पशु आनुवंशिक संसाधन द्वारा समन्वय में कार्य करते हुए क्रियान्वित किया जा रहा है। ब्यूरो पशु आनुवंशिक संसाधनों पर नेटवर्क कार्यक्रम (एनडब्ल्यूपी-एएनजीआर) के लिए एक समन्वय केंद्र के रूप में भी कार्य करता है, जो स्वदेशी एएनजीआर के लक्षण वर्णन और संरक्षण में शामिल देशव्यापी नेटवर्क केंद्रों का समन्वय करता है। विभिन्न राज्यों में एएनजीआर के दस्तावेज़ीकरण के लिए सर्वेक्षण करने और राज्य एजेंसियों के साथ समन्वय करने के लिए, ब्यूरो ने राज्य विशिष्ट छह कार्यात्मक समूह और आठ एनईएच (उत्तरी-पूर्वी पहाड़ी राज्य) समूह भी स्थापित किए हैं। नस्ल पंजीकरण इकाई देश की पशु नस्लों और अन्य विशिष्ट आबादी के पंजीकरण में शामिल है।

भारत के शून्य गैर-वर्णनात्मक पशु आनुवंशिक संसाधन की ओर मिशन

ब्यूरो ने 11 अगस्त, 2021 को 'भारत के शून्य गैर-वर्णनात्मक एएनजीआर की ओर मिशन' की शुरुआत की है। मिशन के तहत, ब्यूरो ने राज्य पशुपालन विभागों सहित विभिन्न पशु हितधारकों के साथ राज्य इंटरफ़ेस बैठकें आयोजित करने की पहल की। राज्य कृषि/पशु चिकित्सा विश्वविद्यालयों, पशुधन विकास बोर्डों/जैव विविधता बोर्डों/राज्यों के गैर सरकारी संगठनों को संबंधित राज्य में एएनजीआर के दस्तावेज़ीकरण के लिए जागरूक करने हेतू 2022 के दौरान, तेलंगाना, पंजाब, हरियाणा, मध्य प्रदेश, पश्चिम बंगाल, हिमाचल प्रदेश, बिहार राज्यों के लिए सात इंटरफ़ेस बैठकें आयोजित की गई। 2022 के अंत तक 12 राज्यों और एक केंद्र शासित प्रदेश के साथ इंटरफेस मीट आयोजित की गई है।

मिशन की शुरुआत के बाद, राज्य पशुपालन विभाग, केवीके, कृषि/पशुचिकित्ससा विज्ञान विवि के सहयोग से विभिन्न राज्यों में एएनजीआर के सर्वेक्षण और दस्तावेज़ीकरण के लिए 17 संस्थागत परियोजनाएं शुरू की गईं (परियोजनाओं की सूची अगले भाग में संलग्न है)। इन परियोजनाओं में देश के 22 राज्य/केंद्र शासित प्रदेश शामिल हैं। मिशन की शुरुआत के बाद, ब्यूरो ने 16 राज्यों और 1 केंद्रशासित प्रदेश में पशुधन, पोल्ट्री और श्वान की नई समरूप आबादी का पता लगाने और उनकी पहचान करने के लिए सर्वेक्षण किया है। 2022 के दौरान, 14 राज्यों - हिमाचल प्रदेश, उत्तर प्रदेश, मध्य प्रदेश, राजस्थान, छत्तीसगढ़, ओडिशा, तमिलनाडु, महाराष्ट्र, बिहार, अरुणाचल प्रदेश, मिजोरम, नागालैंड, सिक्किम, मेघालय और केंद्र शासित प्रदेश लद्दाख में सर्वेक्षण किए गए हैं।

2022 के दौरान, आठ राज्यों में तेरह नई आबादी की पहचान की गई - मध्य प्रदेश की लाहुरी बकरी और डांग भेड़, तमिलनाडु का कोम्बाई श्वान, राजस्थान की माही गोवंश और वागड़ी बकरी, अरुणाचल प्रदेश का एकी श्वान, उत्तर प्रदेश की बत्तीसी बकरी एवं रामपुर हाउंड श्वान, ओडिशा के बुरुडी और गोला शूकर एवं मल्कानगिरी टट्टू एवं बिहार की सीतामढ़ी बकरी एवं सिमांचल भेड़। मिशन के तहत किए गए सभी अन्वेषणों के परिणामस्वरूप 33 नई आबादी की पहचान हुई है। राज्य एजेंसियों के सहयोग से ब्यूरो द्वारा इन पशु समूहों की अध्ययन किया जा रहा है।

वर्ष 2022 के दौरान मिशन के तहत सात राज्यों से संबंधित दस नई आबादी की पहचान की गई है। इनमें शामिल हैं - मध्य प्रदेश के चंबल क्षेत्र की मूल लाहुरी बकरी और डांग भेड़, सिक्किम के सिक्किमी याक, तमिलनाडु के कोम्बाई श्वान, लद्दाख के चांगखी श्वान, मैसिलम गोवंश और मेघालय का वाक चाम्बिल शूकर, छत्तीसगढ़ की सरगुजा बकरी, माही कैटल और राजस्थान की वागड़ी बकरी।

पशुओं की नई देसी नस्लों का पंजीकरण

वर्ष 2022 में पांच राज्यों के पशुधन की दस स्वदेशी नस्लों को आईसीएआर-एनबीएजीआर द्वारा पंजीकृत किया गया है। इन नस्लों को शामिल करने के बाद, पंजीकृत स्वदेशी नस्लों की कुल संख्या 212 तक पहुंच गई है, जिसमें गोवंश की 53, भैंस की 20, बकरी की 37, बकरी की 44 शामिल हैं। भेड़, घोड़ों और टट्टुओं की 7, ऊँट की 9, शूकर की 13, गधे की 3, श्वान की 3, याक की 1, मुर्गी की 19, बत्तख की 2 और हंस की 1। लगभग 12 मिलियन पशुधन को वर्णनात्मक श्रेणी में शामिल किया गया। नई नस्लों का पंजीकरण देश में विभिन्न विकास कार्यक्रमों और नीति निर्माण की शुरुआत करता है। इन सभी पंजीकृत नस्लों को सरकार द्वारा राजपत्र में भी अधिसूचित किया गया है, जिसने देशी नस्लों पर भारत की राष्ट्रीय संप्रभुता प्रदान की।

पूर्णाथडी भैंस महाराष्ट्र राज्य के विदर्भ क्षेत्र में वितरित है। यह आकार में मध्यम है और यह सफेद से हल्के भूरे रंग की होती है। पैर के सिरे और पूंछ का अंतिम सिरा सफेद होता है। सींग लंबे होते हैं और अंत में हुक जैसा दिखता है। प्रति ब्यांत दुग्ध उत्पादन 353 से 1533 किग्रा तक होती है। दूध में वसा का प्रतिशत 6.5 से 11.5 तक होता है।

कथानी एक दोहरे उद्देश्य वाली गाय है। यह मुख्य रूप से पश्चिमी महाराष्ट्र के विदर्भ क्षेत्र में वितरित है। कथानी गोवंश में अच्छी भारवाहक क्षमता होती है, यह धान की खेती के लिए दलदली भूमि की जुताई के लिए उपयुक्त होती है।

सांचोरी एक मध्यम आकार की, अच्छा दूध देने वाला गोवंश है। यह राजस्थान के जालौर जिले में वितरित है। यह सफेद रंग की होती है। प्रति ब्यांत औसत दुग्ध उत्पादन 2769 किग्रा एवं औसत दैनिक दुग्ध उत्पादन लगभग 9 किग्रा है।

मासिलुम मेघालय की एक छोटे आकार की लेकिन सुगठित और मजबूत गोवंश है। यह पहाड़ी पारिस्थितिकी तंत्र के लिए अच्छी तरह से अनुकूलित है। इन गोवंश को खासी और जैंतिया समुदायों द्वारा खेल, खाद और सामाजिक-सांस्कृतिक त्योहारों के लिए पाली जाती है।

सोजत एक बड़े आकार की दोहरे उद्देश्य वाली बकरी है; यह मांस और दूध दोनों उद्देश्यों के लिए पाली जाती है। सोजत मुख्य रूप से राजस्थान के पाली, जोधपुर, नागौर और जैसलमेर जिलों में वितरित है। व्यस्क नर का औसत वजन लगभग 60.0 किग्रा है। मादा का औसत दुग्ध उत्पादन लगभग 1 किग्रा प्रतिदिन होता है।

करौली एक मध्यम से बड़े आकार की बकरी है, जिसे मांस और दूध के लिए पाला जाता है। यह राजस्थान के सवाई माधोपुर, कोटा, बूंदी और बारां जिलों में वितरित है। वयस्क नर का औसत वजन लगभग 52.0 किग्रा है। औसत दैनिक दुग्ध उत्पादन 1.53 किग्रा है।

गुजरी बकरी राजस्थान की एक बड़े आकार की, दोहरे उद्देश्य वाली नस्ल है। इसका रंग चेहरे, पैर और पेट पर भूरा और सफेद के साथ सफेद मिश्रण है। वयस्क नर का औसत वजन लगभग 69.0 किग्रा और मादा में 58.0 किग्रा है। औसत दैनिक दुग्ध उत्पादन 1.61 किग्रा है।

बांडा शूकर झारखंड की मूल नस्ल है, जिसे मुख्य रूप से माँस और खाद के लिए पाला जाता है। जानवर काले रंग के, छोटे और उभरे हुए कान वाले होते हैं। वयस्क नर का औसत शरीर भार 28.0 किग्रा और मादा का 27.0 किग्रा होता है। लीटर का आकार 4 से 7 तक होता है।

मणिपुरी ब्लैक मणिपुर राज्य की मूल शूकर है, जिसे मुख्य रूप से मांस के लिए पाला जाता है। वयस्क नर का औसत शरीर भार लगभग 96.0 किग्रा और मादा में 93.0 किग्रा होता है। जन्म के समय लीटर (पैदा हुए बच्चों की संख्या) का आकार 6 से 11 तक होता है। स्थानीय लोगों द्वारा मांस को उसके स्वाद के लिए पसंद किया जाता है।

वाक चाम्बिल गोल और लटकते पेट वाला एक छोटे आकार का शूकर है। यह मुख्य रूप से मेघालय के गारो हिल्स में वितरित है। इसका मांस अपने विशेष स्वाद के लिए जाना जाता है और मुख्य अवसरों पर इसे सराहा जाता है। व्यस्क नर का औसत शरीर भार 32.0 किग्रा होता है। जन्म के समय लीटर का आकार 4 से 11 तक होता है।

देशी पशु आनुवंशिक संसाधनों का लक्षणीकरण

एनईएच (NEH) सहित विभिन्न राज्यों में कई नई पहचानी गई समरूप आबादी का प्रारूपिक लक्षण वर्णन किया गया। इस वर्ष मेघालय की मासिलुम गोवंश, राजस्थान की देशी माही गोवंश, मध्य प्रदेश की लाहुरी बकरी, लद्दाख की मालरा बकरी, छत्तीसगढ़ की सरगुजा बकरी, राजस्थान की मूल वागड़ी बकरी, मध्य प्रदेश की डांग भेड़, लद्दाख की मार्लुक भेड़ एवं मेघालय के वाकचंबिल शूकर का लक्षण वर्णन किया गया है। मेघालय के शूकर, लद्दाख के चांग-खी श्वान, तमिलनाडु के कोम्बाली श्वान का प्रदर्शन किया गया। मासिलुम गोवंश और वाकचम्बिल शूकर जैसी आबादी को पूर्ण रूप से वर्णन किया गया है और आगे भी पंजीकृत किया गया है। उत्तर प्रदेश के रुहेलखंडी गोवंश, केरल और तमिलनाडु की देशी गोवंश की आबादी, उत्तर प्रदेश की बत्तीसी बकरी, अरुणाचल प्रदेश के एकी श्वान और उत्तर प्रदेश के रामपुर हाउंड श्वान जैसे कई नई पशु समूहों का लक्षण वर्णन भी इस वर्ष के दौरान शुरू किया गया। त्रिपुरा के देशी मुर्गों का दस्तावेजीकरण भी किया गया।

राजस्थान के उदयपुर संभाग के देशी गोवंश (माही) छोटे आकार के, हल्के भूरे या स्लेटी रंग के, सुगठित शरीर वाले होते हैं। इसमें छोटा कूबड़, छोटी गर्दन, पतले और छोटे पैर, सीधा चेहरा, उभरे हुए पोल के साथ छोटा और सीधा माथा

होता है। वयस्क मादाओं और नारों की औसत ऊंचाई क्रमशः 97.0±0.45 और 102.2±1.11 सेमी होती है। दैनिक दुग्ध उत्पादन 1-3 लीटर है और दूध में वसा की मात्रा 3-5% होती है।

लाहुरी बकरी मुख्य रूप से मुरैना के सबलगढ़ क्षेत्र और मध्य प्रदेश के चंबल संभाग के श्योपुर जिलों के विजयपुर, बीरपुर क्षेत्र में वितरित है। ये बकरियां चंबल नदी के बीहड़ों की डांग उत्पादन प्रणाली के लिए अनुकूलित हैं। कुछ क्षेत्रों में, जानवरों को डांग भेड़ के साथ खुली चारण प्रणाली के तहत पाला जाता है। यह सुंदर दिखने वाली मध्यम आकार की बकरी है। शरीर का रंग आगे की ओर, कंधे और अगले भाग पर चमकदार लाल होता है, जो शरीर के पिछले भाग पर चमकदार भूरे से काले रंग में परिवर्तित होता है। लाहुरी बकरी के कान असाधारण रूप से लंबे होते हैं, कुछ मामलों में 28 सेमी तक भी पहुंच जाते हैं। दोनों लिंग अत्यधिक कुंडलित सींग वाले होते हैं। इन बकरियों को मांस के उद्देश्य से पाला जाता है।

मालरा लद्दाख (केन्द्र शासित) की एक गैर-पशमीना बकरी है। यह मध्यम से बड़े आकार की बकरी है जिसे लेह जिले के खलत्से, लामायुरू, लिंगशेट, फोटोक्सर, स्किउ, मरखा, गांवों और कारगिल जिले के निकटवर्ती स्थानों में मांस और खाद के लिए पाला जाता है। इसका शरीर बालों से ढका होता है जो लद्दाख की कडाके की ठण्ड में लाभ देता है। कान आकार में छोटे और उभरे हुए होते हैं। व्यस्क नर का शरीर भार 18-45 किग्रा और मादा का वजन 15-30 किग्रा तक होता है।

सरगुजा छत्तीसगढ़ की एक बकरी है। यह सरगुजा और आसपास के जिलों में केंद्रित है। अधिकांश जानवरों में शरीर का रंग भूरा से गहरा भूरा होता है। शरीर के रंग के आधार पर जनसंख्या में दो अलग-अलग प्रकार होते हैं। वयस्क नर और मादा में शरीर की औसत ऊंचाई क्रमशः 66.5 और 63.4 सेमी होती है।

उदयपुर संभाग की मूल बकरियाँ छोटी और दिखने में काली या लाल-भूरे रंग की होती हैं। मादाओं के स्तन मध्यम शंक्वाकार और छोटे, लटकते थन वाले होते हैं। जांघों पर गुच्छेदार बाल (काले या भूरे) देखे जा सकते हैं। मध्यम आकार के, झुके हुए कान पत्ती की तरह दिखते हैं। सींग छोटे, पीछे की ओर मुड़े हुए, कुछ हद तक ऊपर की ओर मुड़े हुए, आधार पर मोटे और सिरे पर पतले होते हैं एवं सामान्य रूप से पेंचदार होते हैं। हालांकि वे कभी-कभी गोल भी हो सकते हैं। वयस्क मादाओं की शरीर की लंबाई, कंधों पर ऊंचाई और छाती की परिधि का औसत मान क्रमशः 58.6±0.31, 65.5±0.29 और 69.0±0.35 सेमी होती है। प्रतिदिन दूध की पैदावार 300-500 मिली होती है।

डांग भेड़ मध्य प्रदेश के चंबल संभाग के भिंड, मुरैना और श्योपुर जिलों में वितरित है, जिसका घनत्व चंबल नदी के बीहड़ (डांग) क्षेत्र में अधिक है। भेड़-बकरियों में से सभी को खुली चारण व्यवस्था के तहत पाला जाता है एवं ये बीहड़ों में चरते हैं। भेड़ें मध्यम आकार की होती हैं। शरीर का रंग मलाईदार सफेद और चेहरे पर भूरे धब्बे हैं। कान पत्तेदार और मध्य रेखा से मुड़े हुए होते हैं। पूँछ मध्यम लंबाई की, शुरुआत में मोटी और अंत में पतली होती है। ऊन मध्यम मोटाई का, घना और थोड़ा घुंघराला होता है। वयस्क मादाओं में औसत भार 35.13 किग्रा होता है। इन भेड़ों को मुख्यतः मांस उत्पादन के लिए पाला जाता है।

मल्लुक भेड़ लेह जिले के लिंगशेट, फोटोक्सर, स्किउ, मार्खा, लामायुरू, खलत्से और हनु क्षेत्र के साथ-साथ कारगिल जिले के ज़न्सकार ब्लॉक के कुछ हिस्सों में वितरित है। जानवर छोटे से मध्यम आकार के, लंबे नुकीले चपटे सिर वाले होते हैं। ये अपनी रोग प्रतिरोधक क्षमता एवं मजबूती के लिए जाने जाते हैं। शरीर का रंग सफेद होता है; हालाँकि, काले रंग वाले जानवर भी मौजूद हैं। सिर और कान आमतौर पर भूरे रंग के होते हैं और माथे पर सफेद धब्बे होते हैं। शरीर अपेक्षाकृत महीन ऊन से ढका होता है। शरीर की लंबाई और ऊंचाई क्रमशः मादाओं में 48.39±0.76 और 51.41±0.69 और नरों में 52.68±0.74, 55.62±0.69 होती है।

एक सर्वेक्षण त्रिपुरा राज्य के पश्चिमी त्रिपुरा, गोमती, सिपाहीजाला, खोवाई और धलाई जिलों में स्वदेशी चिकन आबादी का अध्ययन करने के लिए आयोजित किया गया। देशी मुर्गियों को ज्यादातर अर्ध-गहन पालन प्रणाली के तहत पाला जाता है। अधिकांश पक्षियों में पंखों का पैटर्न धब्बेदार प्रकार का होता है और पंखों का रंग अलग-अलग होता है। वार्षिक अंडा उत्पादन 40 से 45 अंडे तक होता है। फिनोटाइप में महत्वपूर्ण भिन्नता के कारण, इन पक्षियों को संभावित नई नसल के रूप में वर्गीकृत नहीं किया जा सका।

चांगखी, एक निगरानी श्वान के रूप में चांगथांग के चांगपा खानाबदोशों द्वारा अपने पशुधन मुख्य रूप से चांगथांगी भेड़ और चांगथांगी बकरी की रक्षा के लिए पाला जाता है। शरीर का रंग दो प्रकार के देखे गए। एक पूरा हिरण या हल्का भूरा रंग वाला और दूसरा पूरा काला रंग वाला और आँखों और चेहरे के चारों ओर हिरण के बच्चे के समान वाला या भूरे रंग के धब्बों वाला। यह चांग्पा खानाबदोशों का एक अभिन्न अंग है।

माना जाता है कि कोम्बाई कुत्तों की उत्पत्ति थेनी जिले के कोम्बाई नामक गाँव से हुई थी, हालाँकि, ये पूरे तमिलनाडु में वितरित हैं। इन्हें मुख्य रूप से कृषि क्षेत्र और फार्म हाउसों के रक्षक श्वान के रूप में रखा जाता है। अधिकांश कॉम्बी कुत्तों के बाल छोटे होते हैं और उनका रंग लाल भूरे रंग से लेकर हल्के भूरे रंग तक होता है, साथ ही उनका थूथन और नाक काले होते हैं। कान मध्यम आकार के होते हैं, अधिकांश कुत्तों के कान झुके हुए या अर्ध-झुके हुए होते हैं। पूँछ लंबी, पतली और बाहर के सिरे पर थोड़ी घुमावदार होती है। वे सतर्कता, उच्च आक्रामकता और वफादारी के लिए जाने जाते हैं।

पशुधन जनसंख्या एकरूपता का आकलन महत्वपूर्ण पहलू है; आर्टिफिशियल इंटेलिजेंस (एआई) के उपयोग से समस्या का समाधान करने में मदद मिल सकती है। चित्रों से जानवरों के विभाजन और फिनोटाइपिंग के प्रकारों का पता लगाने के लिए एक परियोजना शुरू की गई है। मॉडल मापदंडों को दुरुस्त किया जा रहा है। AnGR डेटाबेस में उपलब्ध गोवंश और भेड़ों की पशु तस्वीरों का उपयोग जानवरों की छवियों को विभाजित करने के लिए परीक्षण के रूप में किया जा रहा है।

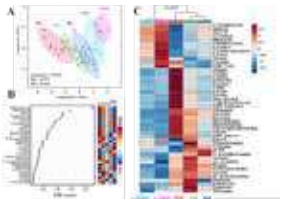
एसएनपी चिप जीनोटाइपिंग का उपयोग करके मिश्रित गैर-वर्णनात्मक गोवंश की आबादी संरचना निर्धारित करने के लिए एक परियोजना शुरू की गई। जीजीपी 50K एसएनपी चिप का उपयोग करके 9 गोवंश की आबादी के कुल 192 डीएनए नमूनों को जीनोटाइप किया गया था। प्रिंसिपल कंपोनेंट एनालिसिस (पीसीए) का उपयोग करके पशु संख्या संरचना ने बिहार और झारखंड (गंगातीरी, बछौर, पूर्णिया और शाहाबादी) और महाराष्ट्र (खामगांव, नॉनडेस्क्रिप्ट, गौलाओ और क्रॉसब्रेड) की गोवंश आबादी के बीच स्पष्ट अंतर दिखाया।

देश की देशी बकरी नस्लों में संपूर्ण जीनोम एसएनपी आधारित विविधता का विश्लेषण किया गया। भारतीय बकरी नस्लों ने एफएसटी मूल्यों के आधार पर 94% नस्ल विविधता प्रदर्शित की। नस्ल विशिष्ट एसएनपी और आईएनडीईएल कन्नी अडू में सबसे अधिक मात्रा में थे, जबकि झारखंड ब्लैक में सबसे कम थे। बढ़ी हुई नस्ल विविधता विभिन्न नस्लों में उच्च जीन प्रवाह का परिणाम हो सकती है। एलडी विश्लेषण से पता चला कि झारखंड ब्लैक, संगमनेरी और टेलिचेरी को छोड़कर सभी नस्लों के लिए एलडी 10 केबी दूरी के भीतर 0.2 से नीचे क्षय हो गया। परिणामों से पता चला कि झारखंड ब्लैक, कन्नी अडू, संगमनेरी और टेलिचेरी अन्य भारतीय नस्लों से बहुत अलग है।

भारतीय भेड़ आनुवंशिक संसाधनों में मातृ विविधता की एक व्यापक तस्वीर प्राप्त करने के लिए 22 नस्लों/आबादी का प्रतिनिधित्व करने वाली 88 भारतीय भेड़ों के संपूर्ण माइटोकॉन्ड्रियल जीनोम अनुक्रमों का विश्लेषण किया गया। भारतीय भेड़ों में कुल 84 नए हैप्लोटाइप की पहचान की गई, जिसमें समग्र हैप्लोटाइप विविधता (एचडी) मान 0.999 और न्यूक्लियोटाइड विविधता (π) 0.00183 के बराबर है। उत्तरी समशीतोष्ण, दक्षिणी प्रायद्वीपीय, पूर्वी और उत्तर-पश्चिमी शुष्क और अर्ध-शुष्क क्षेत्रों का प्रतिनिधित्व करने वाले चार अलग-अलग समूहों के बीच एएमओवीए विश्लेषण ने समूहों के

भीतर अधिकतम आनुवंशिक भिन्नता को जिम्मेदार ठहराया। भारतीय भेड़ों ने दुनिया भर में रिपोर्ट किए गए हापलोग्रुप ए और बी के अनुरूपता दिखाई।

नेटवर्क प्रोजेक्ट के तहत तीन केंद्र शुरू किए गए: पूर्वी क्षेत्र का आईसीएआर अनुसंधान परिसर, पटना (बिहार), महाराष्ट्र पशु एवं मत्स्य विज्ञान विश्वविद्यालय, नागपुर (महाराष्ट्र) और राज्य पशुपालन विभाग, अरुणाचल प्रदेश। इन केंद्रों द्वारा पहचानी गई आबादी को मानकीकृत प्रश्नावली के साथ व्यवस्थित सर्वेक्षण के बाद विस्तार से अध्ययन किया जा रहा है।



देशी पशु आनुवंशिक संसाधनों का मूल्यांकन

लद्दाख की देशी गायें अद्वितीय हैं और उच्च ऊंचाई वाले हाइपोबेरिक हाइपोक्सिया स्थितियों के लिए अच्छी तरह से अनुकूलित हैं। लद्दाखी गायों और याक के चयापचय हस्ताक्षर स्थापित किए गए। लद्दाखी गोवंश में, 8 अलग-अलग वर्गों जैसे कार्बनिक अम्ल, अमीनो एसिड, कार्बनिक नाइट्रोजन यौगिक, कार्बोहाइड्रेट, न्यूक्लिक एसिड, बेंजीनोइड्स, फैटी एसाइल्स और से कुल 46 मेटाबोलाइट्स; 1डी 1एच 800 मेगाहर्ट्ज एनएमआर स्पेक्ट्रोस्कोपी का उपयोग करके कार्बनिक ऑक्सीजन यौगिकों का पता लगाया गया। इनमें से, 31 मेटाबोलाइट्स ने कोलोस्ट्रम (0-दिन), संक्रमण (2-&4-दिन) और परिपक्व दूध (<30-&>30-दिन) में उनकी सांद्रता में महत्वपूर्ण अंतर (पी<0.01) दिखाया। कई मेटाबोलाइट्स ने कोलोस्ट्रम (0-दिन) में उच्चतम संवर्धन दिखाया, जबकि परिपक्व दूध के नमूनों में संक्रमण के दौरान उनके स्तर में धीरे-धीरे गिरावट आई। लद्दाखी गायों के कोलोस्ट्रम में ब्रांच्ड चेन अमीनो एसिड - वेलिन, ल्यूसीन, आइसोल्यूसीन का उच्च स्तर देखा गया। संवर्धन विश्लेषण ने कोलोस्ट्रम और परिपक्व दूध के चयापचय डेटा की तुलना करने पर शीर्ष 25 मेटाबोलाइट समृद्ध टर्म की पहचान की। इस तरह के निष्कर्ष लद्दाखी गाय के कोलोस्ट्रम का मूल्य बढ़ाने में सहायक होंगे।

लद्दाखी के विभिन्न बायोफ्लुइड्स (सीरम, लार, मूत्र, मल) के मेटाबोलिक प्रोफाइल 1H-NMR द्वारा उत्पन्न किए गए। पांच जैविक तरल पदार्थों में कुल 249 मेटाबोलाइट्स की पहचान की गई। इनमें से केवल 8 मेटाबोलाइट्स ही सभी बायोफ्लुइड्स में सामान्य थे। बाकी मेटाबोलाइट्स या तो अलग-अलग बायोफ्लुइड्स में विशिष्ट रूप से मौजूद थे या आंशिक रूप से ओवरलैप थे।

इम्युनोग्लोबुलिन (आईजीजी1, आईजीए, आईजीएम) और रोगाणुरोधी गुणों वाले दो प्रमुख मट्ठा प्रोटीन (लैक्टोफेरिन और लाइसोजाइम) और वृद्धि कारक (इंसुलिन वृद्धि कारक) का अनुमान कोलोस्ट्रम, परिपक्व दूध (60-90 दिन) में लद्दाखी गोवंश और लद्दाखी याक में प्राकृतिक रूप से लगाया गया। गोजातीय विशिष्ट एलिसा किट का उपयोग करके, हाइपोबेरिक हाइपोक्सिया स्थिति के लिए अनुकूलित किया गया। IgG1, IgG2, IgA और IgM की सांद्रता साहीवाल की तुलना में लद्दाखी गोवंश के कोलोस्ट्रम में अधिकतम पाई गई। इसके अलावा, तीनों प्रकार के जानवरों के परिपक्व दूध के नमूनों (60-90 दिन) के स्तर में काफी गिरावट आई। कोलोस्ट्रम के नमूनों में लाइसोजाइम की सांद्रता भी अपेक्षाकृत अधिक थी जोकि फिर परिपक्व दूध में थोड़ी कम हो गई। इसके विपरीत, तीनों पशु समूहों में कोलोस्ट्रम की तुलना में परिपक्व दूध में लैक्टोपरोक्सीडेज का स्तर अधिक मिला।

इंडिकस, टॉरिन और क्रॉस ब्रीड गायों के दूध से पृथक एक्सोसोम की आकृति विज्ञान की पुष्टि टीईएम से की गई, जबकि आकार वितरण और कण संख्या की जांच नैनोकण ट्रैकिंग के माध्यम से की गई। मेटाबोलोम प्रोफाइलिंग से दूध से प्राप्त एक्सोसोम में मौजूद 41 अलग-अलग मेटाबोलाइट्स की उपस्थिति का पता चला, जिनमें से 23 को इंडिकस, टॉरिन और क्रॉसब्रेड गायों में अलग-अलग विनियमित (≤0.05 पी-वैल्यू) किया गया। एक आरएनए लाइब्रेरी तैयार की गई है।

वेक्टर-जनित हेमोप्रोटोज़ोअन रोगों (थिलेरियोसिस और एनाप्लाज्मोसिस) से संक्रमित गोवंश के पीबीएमसी में पहचाने गए विभेदित रूप से व्यक्त जीन प्रतिरक्षा प्रणाली, साइटोकिन्स और माइटोटिक चक्र के विनियमन से जुड़े थे, जबकि गैर-संक्रमित जानवरों में वे हिस्टोन डीएसेटाइलेज (एचडीएसी), टेलोमेरेज़ रखरखाव से संबंधित थे। साथ ही न्यूक्लियोसोम असेंबली। स्वस्थ पशुओं में समृद्ध पथ और जीन क्रोमैटिन अखंडता के रखरखाव का सुझाव देते हैं।

काले (कड़कनाथ) और सफेद मांस (ब्रॉयलर) पक्षियों की पेक्टोरलिस प्रमुख मांसपेशियों के आरएनए अनुक्रमण-आधारित तुलनात्मक अभिव्यक्ति विश्लेषण से कड़कनाथ में मेलानोजेनेसिस और सेलुलर अनुकूलन और ब्रॉयलर में वृद्धि से जुड़े महत्वपूर्ण जीन और मार्गों का पता चला।

भैंस के बैलों के शुक्राणु जीनोमिक डीएनए के कम प्रतिनिधित्व वाले बाइसल्फाइट अनुक्रमण (आरआरबीएस) का उपयोग करके, गर्मी के तनाव के कारण अलग-अलग वीर्य की गुणवत्ता वाले, प्रमोटर और इंटरजेनिक क्षेत्रों में हाइपरमेथिलेटेड सीपीजी के साथ शुक्राणुजनन से जुड़े प्रमुख जीन की पहचान की गई, जो शुक्राणु फंक्शन महत्वपूर्ण भूमिका निभाते हैं। वीर्य की गुणवत्ता. मौसमी रूप से प्रभावित और गैर-प्रभावित सांडों के शुक्राणु कोशिकाओं में माइटोकॉन्ड्रियल प्रतिलिपि संख्या का विश्लेषण किया गया, जो बिना किसी महत्वपूर्ण भिन्नता के पाया गया । वास्तविक समय पीसीआर आधारित जीन अभिव्यक्ति विश्लेषण के लिए, बी2एम और ईईएफ2 को भैंस बैल के शुक्राणु में सबसे दृढ़ता से व्यक्त आंतरिक हाउसकीपिंग जीन के रूप में पहचाना गया है।

पशुधन में जीनोमिक भविष्यवाणी की सटीकता एसएनपी मार्करों के साथ-साथ संदर्भ जनसंख्या के आकार से प्रभावित होती है। जीनोमिक चयन की सटीकता को अधिकतम करने के लिए, एसएनपी मार्करों के सबसेट को खोजने के लिए आनुवंशिक एल्गोरिदम (जीए) का उपयोग किया गया था जोकि जीनोमिक चयन की सटीकता को बढ़ाएगा। जीए ने पूरे सेट के साथ आरआर-बीएलयूपी की मिलान भविष्यवाणी सटीकता प्रदान करने के लिए लगभग आधे एसएनपी मार्करों के साथ-साथ जानवरों का भी चयन किया। इसने प्रशिक्षण-सेट से यादृच्छिक रूप से चुने गए जानवरों की आधी संख्या के लिए आरआर-बीएलयूपी का उपयोग करके प्राप्त की गई तुलना में उच्च भविष्यवाणी सटीकता प्रदान की।

वर्ष के दौरान तीन राज्यों के 11 सरकारी संस्थानों द्वारा प्रजनन के उद्देश्य से रखे गए 205 गोवंश और भैंसों के लिए साइटोजेनेटिक स्क्रीनिंग की गई। बीएलएडी, सिट्रुलिनमिया फैक्टर XI की कमी और डंप्स (केवल एचएफ और एचएफ क्रॉस) के लिए आनुवंशिक रोगों के लिए डीएनए परीक्षण के लिए कुल 5 गोवंश बैलों की भी जांच की गई। 235 गोवंश के लिए A1A2 जीनोटाइपिंग की गई।

देशी पशु आनुवंशिक संसाधनों का संरक्षण

आईसीएआर-एनबीएजीआर अपने राष्ट्रीय जीन बैंक में जर्मप्लाज्म को क्रायोप्रिजर्व करके पशुधन की स्वदेशी नस्लों का संरक्षण कर रहा है। 2022 कृषि पशु जननद्रव्य के क्रायोप्रिजर्वेशन के लिए एक उत्कृष्ट वर्ष रहा। इस वर्ष, 29 स्वदेशी नस्लों (15 नस्लों की 30660 वीर्य खुराक और 14 नस्लों की दैहिक कोशिकाओं की 1740 शीशियाँ) के जर्मप्लाज्म को राष्ट्रीय जीन बैंक में क्रायोप्रिज़र्व किया गया था। इसके अलावा 5 देशी नस्लों- चांगथांगी, भकरवाल बकरी, गुरेज, चांगथांगी और करनाह भेड़ के 95 ओसाइट्स (विट्रीफाइड) को भी हिमीकृत किया गया। वर्तमान में, वीर्य के रूप में 59 देशी पशुधन नस्लों के जर्मप्लाज्म और दैहिक कोशिकाओं के रूप में 34 पशुधन नस्लों के जर्मप्लाज्म को क्रायोप्रिजर्व किया गया है। ब्यूरो ने अपने राष्ट्रीय जीनबैंक में वीर्य/दैहिक कोशिकाओं/ओवा के रूप में 'जोखिम वर्ग की' 19 स्वदेशी नस्लों (जोखिम वर्ग में 50 प्रतिशत नस्लें) के जर्मप्लाज्म को क्रायोप्रिजर्व किया है। संस्थान देशी बहुमूल्य

कार्यकारी सारांश

जैव विविधता को संरक्षित करने के अलावा, सतत विकास लक्ष्य (एसडीजी) संकेतक 2.5.1 को भी पूरा करता है।

देशी नस्लों की जोखिम स्थिति का आकलन करने के लिए नस्ल निगरानी सूची 2022 तैयार की गई। जोखिम की स्थिति का आकलन जनसंख्या के आधार पर किया गया था जैसा कि पशुपालन और डेयरी विभाग (डीएएचडी), एमओएफएएचडी, सरकार द्वारा प्रकाशित पशुधन और पोल्ट्री की नस्ल वार रिपोर्ट (20वीं पशुधन जनगणना के आधार पर) में बताया गया है। भारत की विभिन्न पशुधन और कुक्कुट प्रजातियों की 38 स्वदेशी नस्लें संख्या के आधार पर 'खतरे में' हैं। इनमें से 14 नस्लें 'असुरक्षित' श्रेणी में हैं, 19 नस्लें 'लुप्तप्राय' श्रेणी में हैं और 5 नस्लें 'गंभीर' श्रेणी में हैं; खाद्य एवं कृषि संगठन (2013) दिशानिर्देशों के अनुसार।

अनुसंधान परियोजना एव प्रकाशन

ब्यूरो के अनुसंधान प्रयास 29 संस्थान परियोजनाओं, 5 बाह्य वित्त पोषित परियोजनाओं और एक अंतर्राष्ट्रीय परमाणु ऊर्जा एजेंसी (IAEA) परियोजना के तहत पूरे किए जा रहे हैं। अंतर्राष्ट्रीय परमाणु ऊर्जा एजेंसी (IAEA) द्वारा वित्त पोषित 'भारत की विविध देशी भैंस नस्लों में जीनोमिक विविधता, जनसंख्या संरचना और जनसांख्यिकीय गतिशीलता का परिसीमन' पर पहली अंतर्राष्ट्रीय परियोजना ब्यूरो में शुरू की गई।

वर्ष 2022 के दौरान ब्यूरो के वैज्ञानिकों द्वारा अंतर्राष्ट्रीय पत्रिकाओं में 19 सहित 39 शोध पत्र प्रकाशित किए गए।

तकनीकियां

भैंस में जीनोम-वाइड क्यूटीएल पर 4 पेटेंट आवेदनों के लिए पहली परीक्षा रिपोर्ट दायर की गई। स्वदेशी गोवंश और भैंसों की नस्लों पर एसएनपी/जीनोटाइप डेटा को एक संयुक्त एसएनपी चिप डिजाइन करने के लिए एनडीडीबी को हस्तांतरित किया गया, जिसका उपयोग देश में जीनोमिक चयन के लिए किया जाएगा। संगठन के बीच डाटा ट्रांसफर समझौते पर भी हस्ताक्षर किये गये।

पुरस्कार एवं मानद्

ब्यूरो के वैज्ञानिकों के अनुसंधान प्रयासों को सम्मेलनों/संगोष्ठियों और वैज्ञानिक समितियों की फ़ेलोशिप के दौरान सर्वश्रेष्ठ प्रस्तुति पुरस्कार के रूप में सराहा गया।

क्षमता निर्माण

"स्वदेशी घरेलू पशु विविधता के प्रबंधन पर प्रक्षेत्र पशु चिकित्सा अधिकारियों की क्षमता विकास" (14-18 नवंबर, 2022) पर ऑनलाइन प्रशिक्षण आयोजित किया गया। प्रशिक्षण में 18 राज्यों/केंद्रशासित प्रदेशों के कुल 52 पशुचिकित्सकों ने भाग लिया।

ब्यूरो में "पशु आनुवंशिक संसाधन (AnGR) प्रबंधन के लिए समकालीन प्रौद्योगिकी" (21-22 सितंबर, 2022) पर राष्ट्रीय संगोष्ठी का आयोजन किया, जिसमें लगभग 300 प्रतिनिधियों ने भाग लिया।

किसान जागरूकता कार्यक्रम

त्रिपुरा, सिक्किम और हरियाणा में 240 लाभार्थियों को कवर करते हुए छह एससीएसपी कार्यक्रम आयोजित किए गए। इस दौरान 3 प्रदर्शनियों (लुधियाना, ICAR-SBI करनाल, ICAR-IIWBR करनाल) में भाग लिया गया। मेरा गांव मेरा गौरव के तहत दो किसान जागरूकता कार्यक्रमों का आयोजन किया गया। लद्दाख (केन्द्र शासित) में 4 विचार गोष्ठी और जागरूकता शिविर और 2 एमजीएमजी कार्यक्रम आयोजित किए। AKAM के अंतर्गत प्रख्यात वक्ताओं द्वारा AnGR प्रबंधन

पर 3 वैज्ञानिक व्याख्यान आयोजित किए गए इसमें ब्यूरो और अन्य आईसीएआर संस्थानों के कर्मचारी, गैर सरकारी संगठनों के लोग कार्यक्रम में भाग लेते हैं।

समारोह आयोजन

देशी नस्लों के संरक्षण के लिए उत्कृष्ट प्रयासों के लिए 4 किसानों और 8 संस्थानों को किसान दिवस (23 दिसंबर 2022) पर नस्ल संरक्षण पुरस्कार-2022 प्रदान किया गया।

ब्यूरो के वैज्ञानिकों ने 2022 के दौरान कई प्रशिक्षण कार्यक्रमों, राष्ट्रीय/अंतर्राष्ट्रीय सम्मेलनों और वेबिनारों में भाग लिया। उन्होंने प्रशिक्षण कार्यक्रमों के दौरान आमंत्रित व्याख्यान भी दिए।

वैज्ञानिकों एवं छात्रों के लाभ के लिए आजादी का अमृत महोत्सव व्याख्यान श्रृंखला के तहत प्रख्यात वक्ताओं के व्याख्यान आयोजित किए गए।

ब्यूरो में SOCDAB राष्ट्रीय संगोष्ठी का आयोजन किया जिसमें देश भर के प्रतिनिधियों की भागीदारी हुई।

ब्यूरो ने 21 सितंबर, वर्ष 2022 को अपना 39वां स्थापना दिवस मनाया। वैज्ञानिक, तकनीकी, प्रशासनिक और कुशल सहायक कर्मचारी श्रेणी में सर्वश्रेष्ठ कर्मिकों को पुरस्कार से सम्मानित 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 मनाया गया।

राष्ट्रीय स्वच्छता अभियान और वेस्ट टू वेल्थ अभियान जैसे विभिन्न कार्यक्रमों में ब्यूरो कर्मचारियों की सक्रिय भागीदारी रही।

बैठकों का आयोजन

संस्थान अनुसंधान समिति (आईआरसी), अनुसंधान सलाहकार समिति (आरएसी) एवं नेटवर्क परियोजना की वार्षिक समीक्षा बैठक का समय पर आयोजन कर विभिन्न अनुसंधान परियोजनाओं की प्रगति की समीक्षा सुनिश्चित की गयी। संस्थान की बाह्य वित्त पोषित परियोजनाओं की भी संबंधित फंडिंग एजेंसियों द्वारा समीक्षा की गई। संस्थान प्रबंधन समिति की बैठक के दौरान संस्थान के विभिन्न प्रबंधन मुद्दों पर चर्चा की गई।

कार्मिक गतिविधियाँ

वर्ष के दौरान दो वैज्ञानिकों का ब्यूरो में स्थानान्तरण हुआ।

माननीय पशुपालन मंत्री, उत्तर प्रदेश सरकार सहित कई प्रतिष्ठित व्यक्तियों एवं अधिकारियों ने संस्थान का दौरा किया।

Institute 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 and notification of 212 native 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

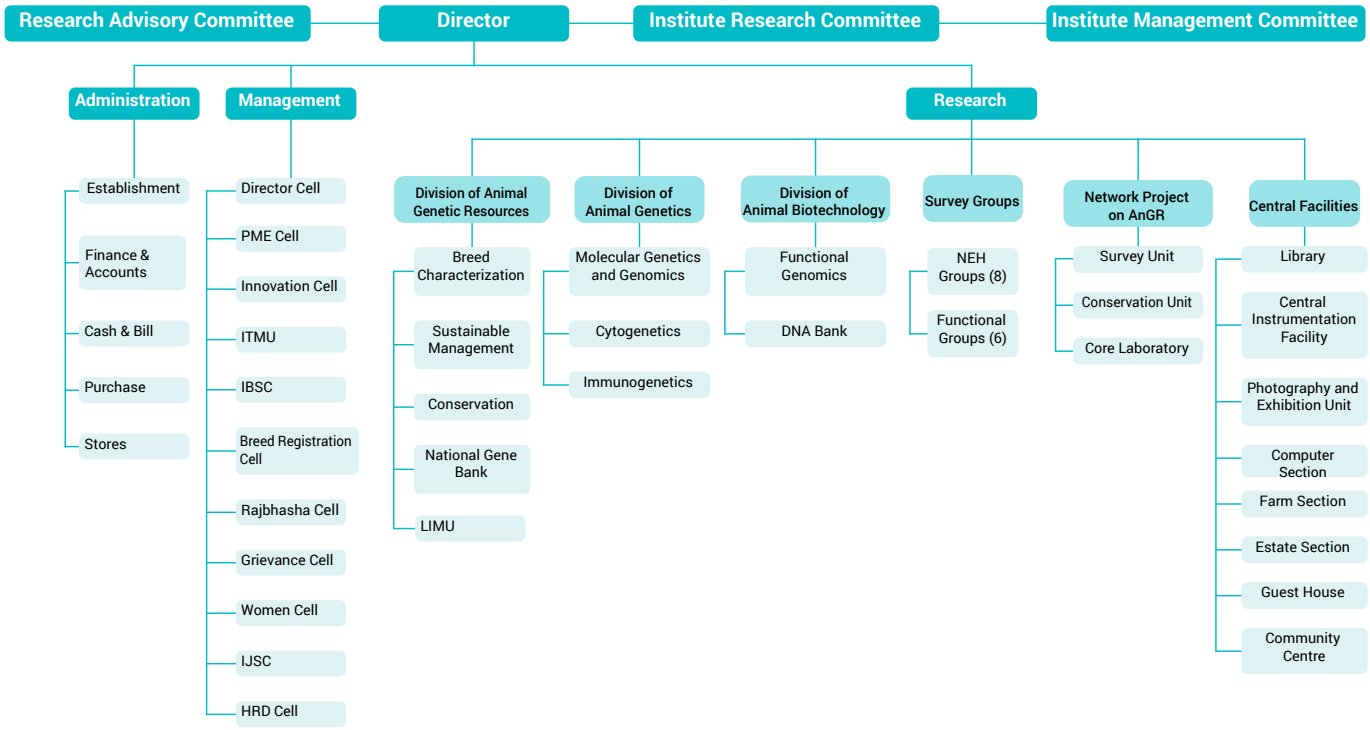
- Identification, evaluation, characterization, conservation and sustainable utilization of livestock and poultry genetic resources of the country
- Coordination and capacity building in animal genetic resources management and policy issues.

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



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.

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

INSTITUTE PROFILE

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.

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

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

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 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, six 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)

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

Priorities and activities

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.

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.

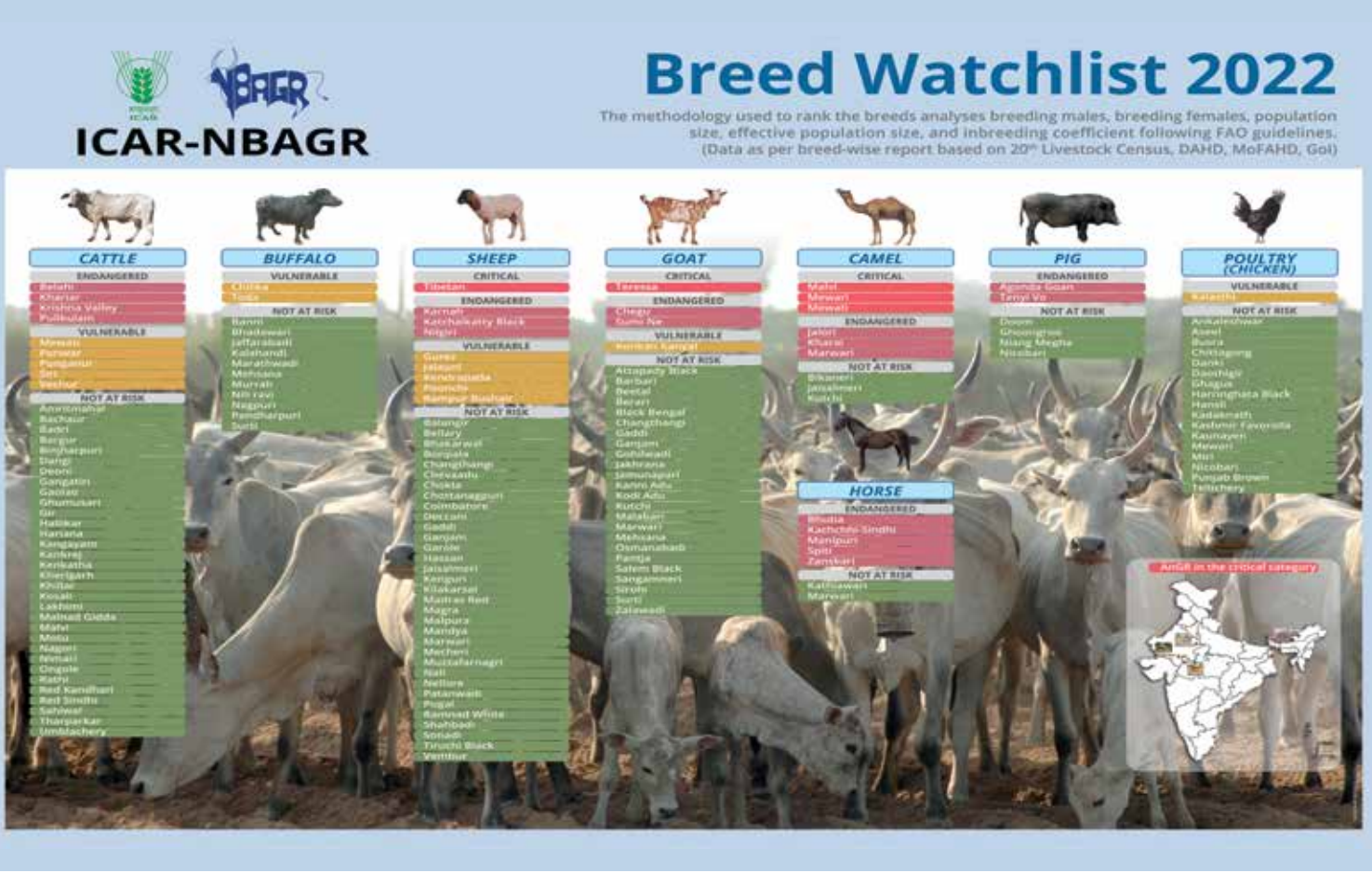
Institute's Priorities

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 212 native breeds have been registered by the NBAGR and all these 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 240 breed/populations of native livestock and poultry in country.
- Registration and Gazatte notification of 212 indigenous animal breeds.
- Cryopreservation of germplasm of >40% 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%.
- 83 new animal breeds described 24 million livestock in country.
- Initiated Breed-wise survey 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 3200 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 212 देशी पशुधन की नस्लों के पंजीकरण और 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

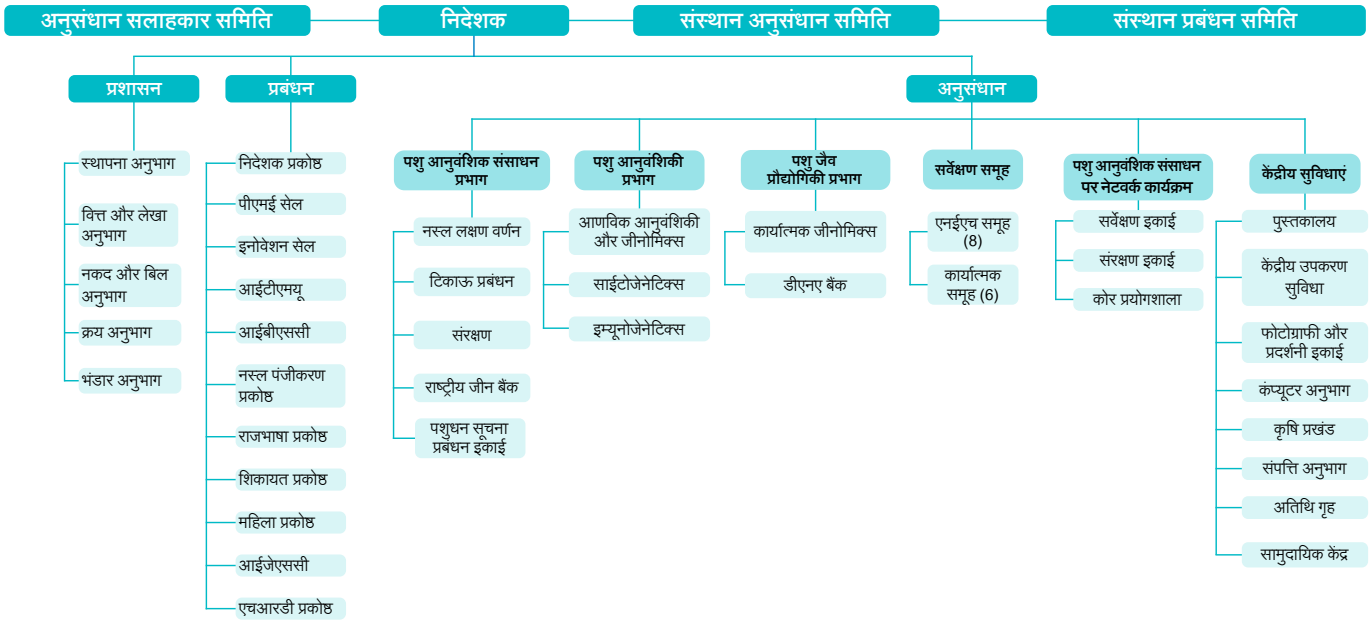
- देश के पशुधन और कुक्कुट आनुवंशिक संसाधन की पहचान, मूल्यांकन, लक्षण वर्णन, संरक्षण और सतत उपयोग।
- पशु आनुवंशिक संसाधन प्रबंधन और नीतिगत मुद्दों में समन्वय और क्षमता निर्माण।

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।

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 रूप 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

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

घटनाक्रम

2013
- पहला मैंस जीनोम ड्राफ्ट का विमोचन
- ब्यूरो की पंजीकृत नस्लों के आधार पर नस्लवार गणना शुरु करना
- ब्यूरो में 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
- भारतीय नस्लों का डीएनए रिपोजिटरी का सुदृढ़ीकरण
- शून्य गैर-वर्णित पशु आनुवंशिक संसाधन की ओर मिशन शुरु
- नस्ल पंजीकरण प्रकोष्ठ की स्थापना

2021
- भारत में पहली बार देशी कुत्तों की नस्लें पंजीकृत
- स्वदेशी पशुधन और कुक्कुट के लिए एसएनपी चिप विकसित

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

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 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)

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

प्राथमिकताएं एवं गतिविधियाँ

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।

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

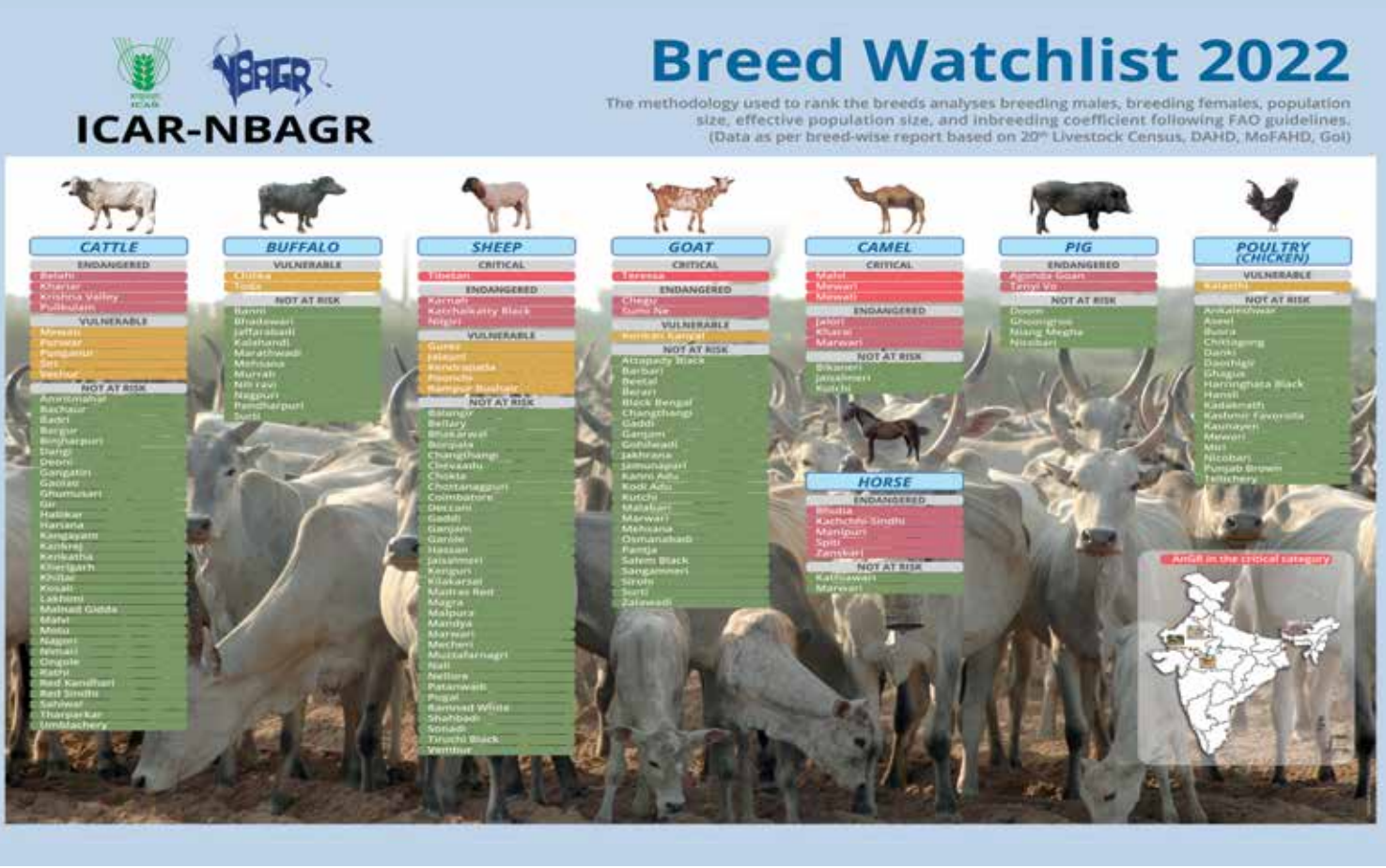
देश में शून्य गैर-विवरणित पशु आनुवंशिक संसाधन के लक्ष्य के साथ सभी पशु आनुवंशिक संसाधनों का दस्तावेज़ीकरण: देश में पशु आनुवंशिक संसाधन में जैव विविधता के प्रबंधन के लिए पशु आनुवंशिक संसाधनों का प्रलेखन सबसे महत्वपूर्ण है। देश में राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो ने अपने सभी प्रयासों के साथ पशु आनुवंशिक 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 212 देशी नस्लों को पंजीकृत किया गया है और इन सभी 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 240 नस्ल/आबादी की विशेषता का अध्ययन उनका और प्रलेखन।
- 212 पशु नस्लों का पंजीकरण एवं गजट अधिसूचना।
- 40% 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।
- 83 नई नस्लों ने देश में 2 करोड़ 40 लाख पशुओं को वर्णित किया।
- पशुपालन और डेयरी विभाग द्वारा देश में नस्ल-वार सर्वेक्षण 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 3200 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, 2021 to March, 2022 alongwith expenditure.

(Rs. In lakhs)

HEAD	Grants		Network Project	
	RE	Exp.	RE	Exp.
Capital				
i) Works	0.00	0.00	0.00	0.00
ii) Other capital expenditure	40.25	25.97	0.00	0.00
Total Capital	40.25	25.97	0.00	0.00
Revenue			68.26	0.23
i) Establishment expenses	1086.36	1085.60	0.00	0.00
ii) Traveling Allowance	15.60	12.11	0.00	0.00
iii) Research & Operational expenses	227.50	115.43	0.00	0.00
iv) Administrative Expenses	201.00	194.60	0.00	0.00
v) Miscellaneous expenses	4.00	1.73	0.00	0.00
Total Revenue	1534.46	1409.47	68.26	0.23
Pension & Retirement benefits	**290.00**	**289.53**	**0.00**	**0.00**
Grant Total	1864..71	1724.97	68.26	0.23

Revenue Generated for the month April, 2021 to March, 2022

(Rs. in lakhs)

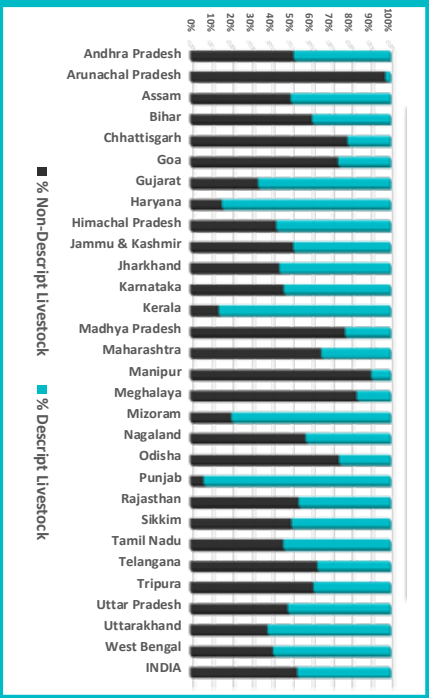
Head of Account	Amount
Sale of Publication & Advertisement	19574
Licence fee	251007
Hostel and Guest house rent	262775
Sale of Technology	-
Sale of farm Produce	-
Others Misc. Revenue Receipts	1882833
Total	2416189

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).



State with non-discript population

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.

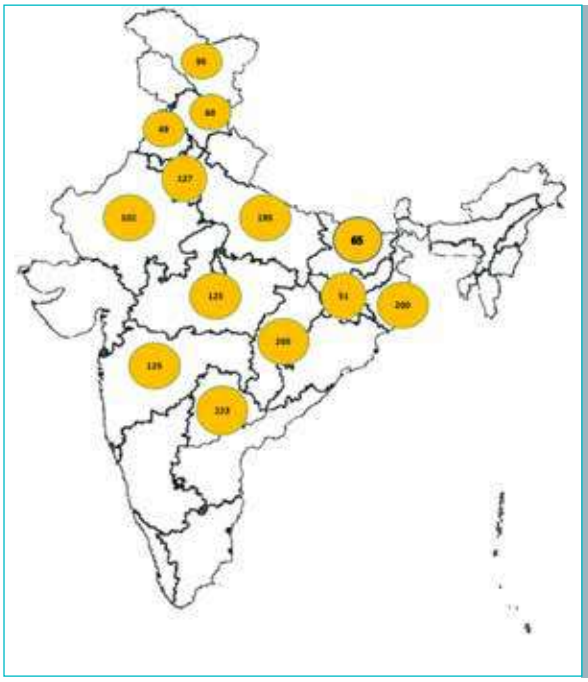
Considering large non-documented AnGR in the country, ICAR- NBAGR has undertaken the characterization and documentation of entire native livestock and poultry in the country in Mission mode in the coming years. “Mission towards Zero Non-Descript AnGR of India” was launched by Dr. T Mohapatra, Secretary, 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

Since its launch, the Mission received a great momentum across the country, and has also been prioritized by the ICAR. For sensitization of the stakeholders the institute is also organizing State Interface Meets. During 2021 five states and one union territory was covered and taking the mission forward, in 2022, ICAR-NBAGR has organized seven Interface Meets for Telangana, Punjab, Haryana, Madhya Pradesh, West Bengal, Himachal Pradesh and Bihar states. Covid pandemic restricted to conduct the meetings in virtual mode. The purpose of these meets to sensitize Animal Husbandry Departments, SAU/SVU, Livestock Development Boards/Biodiversity Boards/ NGOs etc. on documentation of AnGR in their respective state. By the end of 2022, Interface Meets with 12 states and one UT has been completed (Ladakh (UT), Chhattisgarh, Maharashtra, Rajasthan, Uttar Pradesh, Jharkhand, Telangana, Punjab, Haryana, Madhya Pradesh, West Bengal, Himachal Pradesh and Bihar).



Interface Meet with 13 states (number of participants are given in circle)

Telangana

The seventh Interface meet with Telangana state was organized on 10th January, 2022, on the theme of "Characterization and Documentation of Animal Genetic Resources of Telangana: A Mission Towards Zero Non-Descript Populations". The meeting was attended by 223 participants including the senior ICAR officials, ICAR Institutes, PV Narasimha Rao Telangana Veterinary University, Hyderabad, Directorate of Animal Husbandry and Telangana State Biodiversity Board, Hyderabad.

Punjab

Under the Mission Towards Zero Non-descript Animal Genetic Resources, ICAR-NBAGR has organized its 8th State Interface Meet for Punjab on 8th February, 2022, in virtual mode. The meeting on "Characterization and Documentation of Animal Genetic Resources of Punjab" was attended by 49 participants from ICAR, Guru Angad Dev Veterinary & Animal Science University, Animal Husbandry Department Punjab and NGOs.

Haryana

ICAR-NBAGR organized its 9th State Interface Meet for Haryana on 10th February, 2022, in virtual mode. The meeting on "Characterization and Documentation of Animal Genetic Resources of Haryana" was attended by 127 participants from ICAR, LUVAS, Animal Husbandry Department, Haryana and NGOs. During the interface meet, a panel of experts from ICAR institutes, SVU, State AHD. and NGOs provided important inputs for documentation of non-descript AnGR and conservation and improvement of native breeds of the Haryana.

Madhya Pradesh

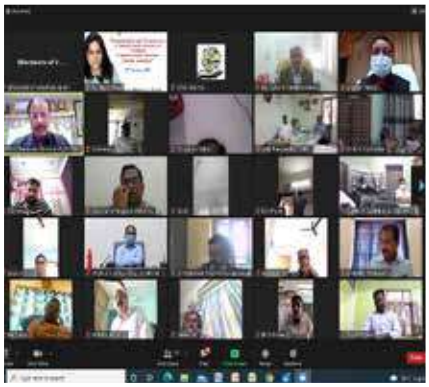
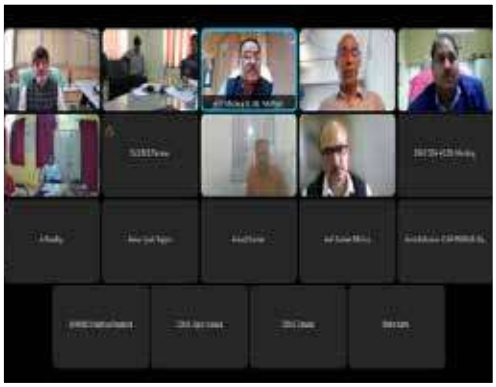
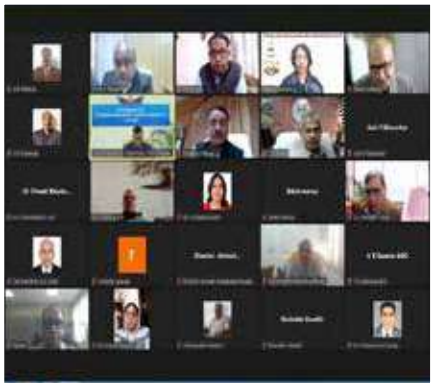
Tenth State-wise Interface meet was organized by ICAR-NBAGR for Madhya Pradesh, in virtual mode on 3rd March, 2022. Under the theme "Characterization and Documentation of Animal Genetic Resources of Madhya Pradesh: A Mission Towards Zero Non-Descript Populations". About 140 scientists/academician/officers of ICAR, Nanaji Deshmukh Veterinary & Animal Sciences University (NDVASU) Animal Husbandry & Dairying Department-MP (AHDD), MP State Livestock & Poultry Dev. Corp. (MPSLPDC), MP state Biodiversity Board and delegates from NGOs participated in the Meet.

West Bengal

Eleventh state specific Interface meet for West Bengal was organized on 19th April 2022 under the Mission, which was attended by about 200 participants of ICAR, West Bengal University of Animal & Fishery Sciences, Department of Animal Husbandry and Veterinary Services and Animal Resource Development West Bengal, NGOs, etc.

Himachal Pradesh

ICAR-NBAGR organized the 12th Interface Meet for Himachal Pradesh state on 'Characterization and Documentation of Animal Genetic Resources of Himachal Pradesh: A Mission towards Zero Non-Descript Population' on 20th April 2022. The meet was attended by more than 60 participants from ICAR, CSKHPKV and DAH, Himachal Pradesh.

Bihar

Thirteenth state Interface meeting for characterization and documentation of Animal Genetic Resources of Bihar state under the Zero Non-descript AnGR Mission was organized in BAMETI, Patna on 13th July 2022. Dr. N. Saravana Kumar, Secretary, Department of Animal and Fisheries Resources, Govt. of Bihar chaired the meeting. Officers of State Animal Husbandry Department, scientist of ICAR and KVK, officials of BASU attended the meeting.

Field surveys for identification of potential breeds

Since launch of the Mission, institutional projects encompassing 22 States/UT of the country were initiated for survey and documentation of AnGR in various states in collaboration with SAHD, KVKs, and SAUs/SVUs.

During 2022, surveys and visits were conducted by Bureau scientists in 14 states - Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhattisgarh, Odisha, Tamil Nadu, Maharashtra, Bihar, Arunachal Pradesh, Mizoram, Nagaland, Sikkim, Meghalaya and one Union Territory of Ladakh. Out of these survey, thirteen new populations have been identified in eight states - Lahuri goat and Dang sheep of Madhya Pradesh, Combai dog of Tamil Nadu, Mahi cattle and Vagdi goat of Rajasthan, Eki dog of Arunachal Pradesh, Battisi goat and Rampur Hound dog of Uttar Pradesh, Malkanagiri pony, Burudi and Gola pig of Odisha, Simanchal sheep and Sitamrhi goat of Bihar.

Since, the launch of the mission, Bureau has undertaken survey in 16 states & 1 UT to explore and identify new homogenous populations of livestock, poultry and dog and identification. As a result 24 new populations, from the country have been identified across the country. Characterization work for ten new populations belonging to seven states have been done by the Bureau in collaboration with state agencies. These included Native Lahuri goat and Dang sheep of Chambal region of Madhya Pradesh, Sikkimese yak of Sikkim, Combai dog of Tamil Nadu, Changkhi dog of Ladakh , Masilum cattle and Wak Chambil pig of Meghalaya, Sarguja goat of Chhattisgarh, Mahi cattlle and Vagadi goat of Rajasthan.

Madhya Pradesh

Bureau scientist visited rural areas of Chambal division of Madhya Pradesh to conduct surveys under Mission in the month of February, 2022. In Bhind, Morena and Sheopur districts of Madhya Pradesh, two distinct populations -Lahuri goat and Dang sheep, were explored in ravines of Chambal river. This population are mainly reared under pastoral system. Both populations were further characterized. Scientist also interacted with the livestock owners and sensitized them about scientific management of the native AnGR.

Uttar Pradesh

In February, 2022, another team of scientists visited Braj region- Agra, Mathura and Noida districts of Uttar Pradesh. During survey one lesser-known goat popluation (*Battisi goat*) and a local buffalo population were found to be unique. Characterization of these populations have also been initiated. The team also interacted with the livestock owners and field functionaries of Animal Husbandry Department, Govt. of Uttar Pradesh.

In another survey in Uttar Pradesh during November, 2022, characterization of Rampur Hound dog was carried out in Rampur district of Uttar Pradesh. Physical, biometry, production traits on Rampur hound dog were recorded.

Tripura

Field survey for characterization of native AnGR in Tripura state was conducted in Tripura in March month of 2022, under the Mission. Survey for characterization of native chicken was conducted in Sepahijala, Khowai and Dhalai districts of Tripura state. Phenotypic characters, reproduction performance, utility of indigenous chicken were recorded.

Tamil Nadu

A survey during March 2022 was conducted by the Bureau scientists to characterize Combai dog of Tamil Nadu. Chennai, Madurai, Thenni & Thoothukudi districts were surveyed. During the survey body biometry, phonotypic characters for adult dogs and bitches and their management practices being followed were recorded.

In another survey for documentation of native AnGR of Tamil Nadu was carried out during May 2022. Rural & urban areas Coimbatore, Tirppur, Erode, Namakkal, Madurai, Theni, Ramanathapuram districts were visited for completing the phenotypic characterization of Combai dog.

Odisha

A survey for documentation of native AnGR in Koraput, Malkangiri and Puri district of Odisha was conducted in April month of year 2022. Two new populations Burudi and Golla of pig and one Malkangiri pony population were identified in Odisha for further characterization.

Arunachal Pradesh

In April 2022, survey for documentation of native AnGR in four districts of Siang and Debang regions of Arunachal Pradesh was conducted. Two new populations - Native dog (Eki) and goat (Arunachali) were identified in Siang region. Characterization of Eki dog, used for guarding, sniffing and tracking of Mithun has been initiated.

Himachal Pradesh

In May, 2022, one native goat population namely Kotdhar (Shiwalik) was explored in Kangra, Bilaspur and Hamirpur districts of Himachal Pradesh. Characterization of the population has been initiated.

Nagaland

A survey of Dimapur, Peren and Kohima districts of Nagaland state was conducted in May 2022, and phenotypic attributes and management practices on native pigs were recorded during survey.

Bihar

In June, 2022, the survey was conducted in various villages of Smastipur, Muzzafarpur, Sitamari, East and West Champaran, Gopalganj, Buxor and Kaimur (Bhabhua) districts of Bihar state for characterization and documentation of indigenous AnGR. One goat, two pig and one poultry populations were found to be uniform for further characterization.

Rajasthan

Survey in field areas of five districts (Udaipur, Rajsamand, Banswara, Chittorgarh and Dungarpur) of Udaipur division of Rajasthan was conducted during July and December, 2022. Two new populations – Mahi cattle and Native goat populations were explored as potential breed in the region. Physical characteristics, biometric

parameters, production, and reproduction traits on animals of both species were recorded. Mahi, a small-statured cattle with 90-95 cm height is distributed in area of Dungarpur, Banswara, Udaipur districts. Native goat with black and dark red coat colour is distributed mainly in tribal regions of Dungarpur and Banswada districts. It is a medium sized goat reared for meat.

Chhattisgarh

Eight districts of Chhattisgarh state covering 25 blocks were surveyed in month of December, 2022, to identify the potential populations for detailed characterization. Homogenous cattle and goat populations were identified in hilly terrain of Surguja division. Blood samples of local populations were collected for genotypic analysis.

Maharashtra

Survey for exploration and identifying new population was conducted in Western Vidarbha region during December, 2022. Eighteen villages of 5 tehsils in 3 districts (Akola, Amravati and Yavatmal) were surveyed to record the different germplasm and interacted with farmers. Five potential populations viz. Kaikadi Donkey, Umarda cattle, Pahari Cattle and Melaghati buffalo were identified.

Mizoram

Data on physical and morphometric characteristics has been recorded in Champhai, Khawzawl, Saitual, Serchip and Lunglei districts for characterization of Mizo cattle and Mithun by the project team. The analysis indicated the presence of homogenous small sized cattle population in the surveyed area while data on Mithun animals revealed two specific phenotypes.

Sikkim

Sikkimese yak population has been characterized by the team of the project. The data on biometry, management practices etc. for Sikkimese yak has been collected from North Sikkim, and East Sikkim in collaboration with local agencies and application for registration of Sikkimese Yak is under preparation.

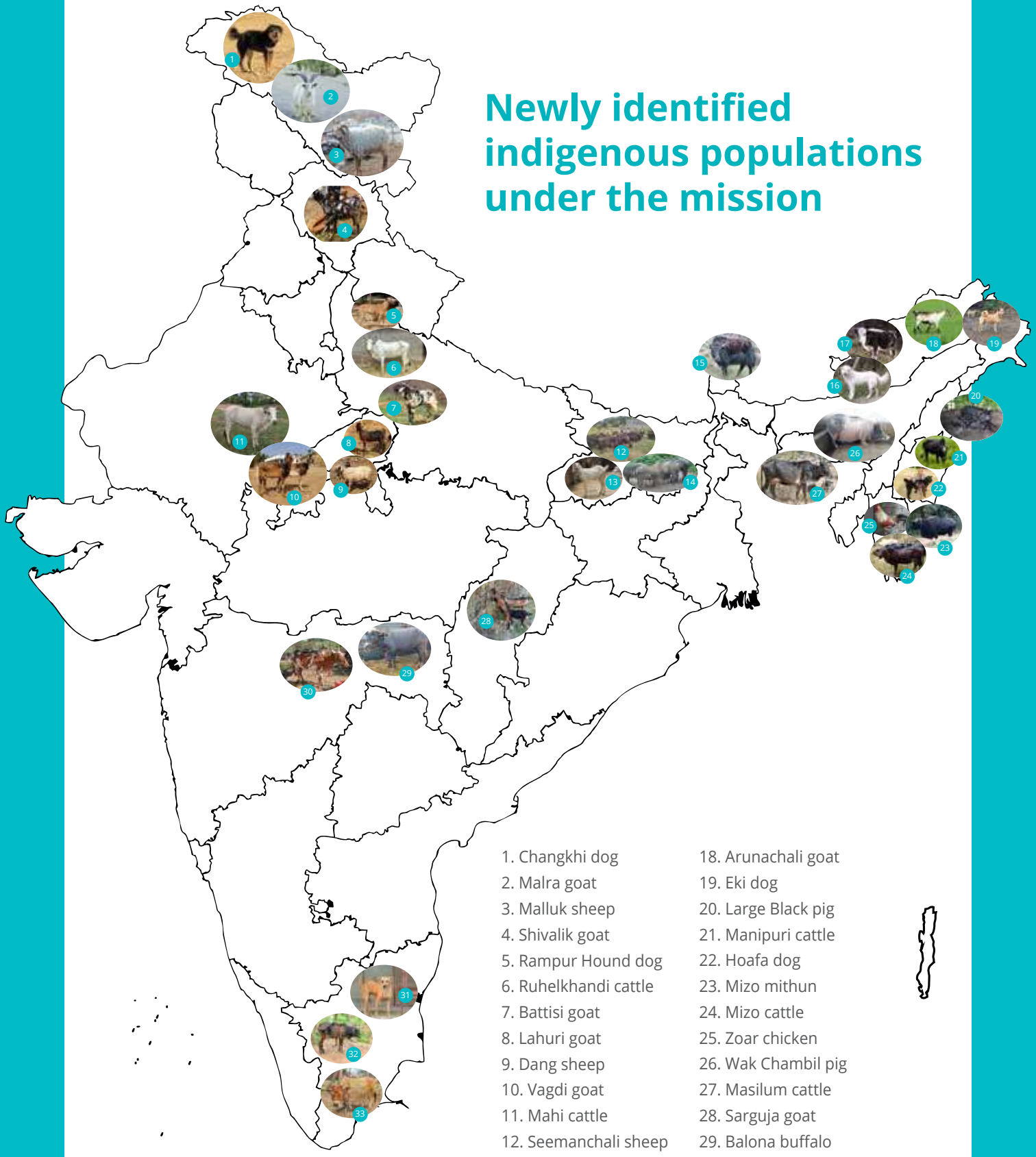
Meghalaya

After surveying different districts of Meghalaya, Masilum cattle and WakChambil pig were identified for characterization. In collaboration with ICAR, Research Complex for NEH Region, Barapani, both the populations were characterized and registered as distinct breeds.

Ladakh (Union Territory)

Field survey of 13 blocks of Leh district has been completed and Gaya-Miru, Karu, Changthang, SkiuMarkha, Wanla-Hanupatta, Kanji-Budhkarbo areas were explored to identify lesser known indigenous populations. Phenotypic characterization of Malluck sheep, Malra goat and Changkhi dog was carried out.

Newly identified indigenous populations under the mission

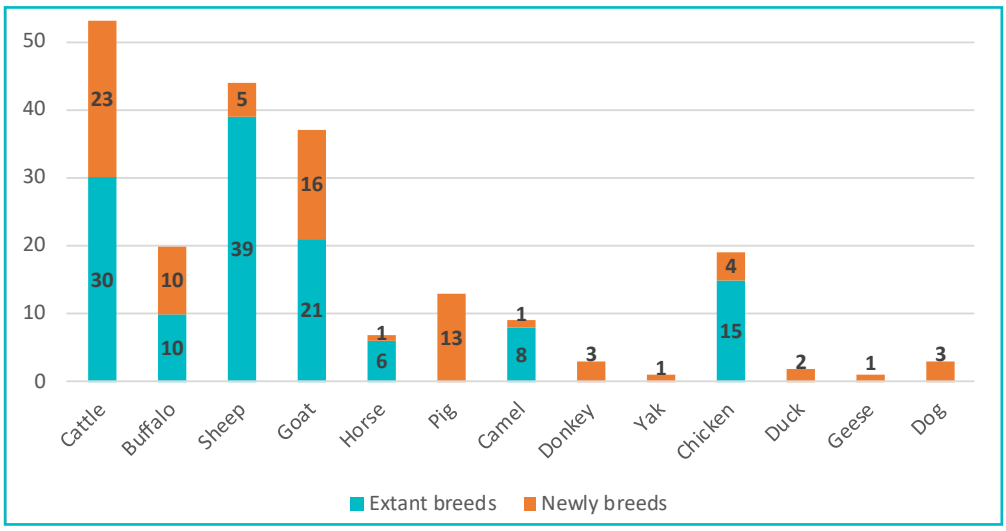


1. Changkhi dog
2. Malra goat
3. Malluk sheep
4. Shivalik goat
5. Rampur Hound dog
6. Ruhelkhandi cattle
7. Battisi goat
8. Lahuri goat
9. Dang sheep
10. Vagdi goat
11. Mahi cattle
12. Seemanchali sheep
13. Sitamarhi goat
14. Champaran pig
15. Sikkimese yak
16. Tawang dog
17. Monbah cattle
18. Arunachali 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

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 ICAR-National Bureau of Animal Genetic Resources, Karnal (NBAGR) is the nodal agency for the registration of breeds of the country. Breed registration Committee in its 10th meeting held on 31th August, 2022 approved registration of ten new breeds of livestock. This includes one breed of buffalo, three breeds of cattle, three breeds of goat, and three breeds of pig. With addition of these newly registered breeds, total number of indigenous breeds now in the country is 212. This includes 53 breeds of cattle, 20 breeds of buffalo, 37 breeds of goat, 44 breeds of sheep, 7 breeds of horses & ponies, 9 breeds of camel, 13 breeds of pig, 3 breeds of donkey, 3 breeds of dog, 1 breed of yak, 19 breeds of chicken, 2 breeds of duck and 1 breeds of geese. During the last 12 years, 83 breeds of different farm animal species were registered across the country.



Number of breeds of livestock & polutry in India


भारत का राजपत्र
The Gazette of India


भारत का राजपत्र
The Gazette of India


भारत का राजपत्र
The Gazette of India

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 (18 breeds) in subsequent years were notified through three more Gazette notifications. 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 2022

S.N.	Breed	Home Tract	Accession number
Buffalo			
1.	Purnathadi	Maharashtra	INDIA_BUFFALO_1100_PURNATHADI_01020
Cattle			
2.	Kathani	Maharashtra	INDIA_CATTLE_1100_KATHANI_03051
3.	Sanchori	Rajasthan	INDIA_CATTLE_1700_SANCHORI_03052
4.	Masilum	Meghalaya	INDIA_CATTLE_1300_MASILUM_03053
Goat			
5.	Sojat	Rajasthan	INDIA_GOAT_1700_SOJAT_06035
6.	Karauli	Rajasthan	INDIA_GOAT_1700_KARAULI_06036
7.	Gujari	Rajasthan	INDIA_GOAT_1700_GUJARI_06037
Pig			
8.	Banda	Jharkhand	INDIA_PIG_2500_BANDA_09011
9.	Manipuri Black	Manipur	INDIA_PIG_1200_MANIPURIBLACK_09012
10.	Wak Chambil	Meghalaya	INDIA_PIG_1300_WAKCHAMBIL_09013

Purnathadi buffalo

Purnathadi name has been derived from the name of local river Purna which originates in Satpura hills and passes through Akola and Amaravati districts of Vidarbha region of Maharashtra. These animals are medium in size, whitish to light brown, while the newborn calves generally have complete whitish coat, which changes to brown as age grows. Patch of white hairs is present on forehead. The lower extremities of all four legs and tail switch is white in most of the buffaloes. Horns are long and tapering, may go up to the shoulder and turned upward in orientation at the end like hook. The daily milk yield, lactation milk yield and fat percentage ranged from 1.1-5.5 kg, 353-1533 kg and 6.5-11.5, respectively.

Kathani cattle

Kathani cattle is a dual purpose, medium sized cattle with compact body, horizontal ears, and straight forehead. It is distributed in Chandrapur, Gadchiroli and Gondia districts of Western Maharashtra (Vidarbha region). Kathani cattle are predominantly white, reddish, and blackish in colour. Horns are straight and curved, poll non-prominent and dewlap small to medium in size. Kathani cattle are well adapted in low input production system and possess good draft ability suited to marshy land for paddy cultivation in stagnated water and rains without having any hoof trouble. Average daily milk yield, lactation milk yield and lactation length are 0.55±0.01 kg, 193.07±5.28 kg and 237.76±1.82 days, respectively.

Sanchori cattle

Masilum cattle

Masilum cattle are small size, well built, sturdy, and well adapted to the hill ecosystem of Meghalaya. These indigenous cattle are available in Hills of Meghalaya and reared by the Khasi and Janitia community. The Khasi language has words 'Masi' and "Lum" that means cattle and Hills, so it is called as "Masilum". The predominant body colour varied from black, brown, and mixture of brown, grey and black. Dewlap and hump are medium in cow while well-developed dewlap and hump with tuft of hair over the hump has been observed in bulls. Horns are short and black in colour. Average daily milk yield, lactation milk yield and lactation length are 2.72±0.45 kg, 456.42±10.53 kg and 168.56±9.28 days, respectively

Masilum bull

Sanchori cattle

It is medium sized cattle with majority of animals are predominantly white in colour with large dewlap. It is distributed in Sanchore, Raniwara, Bhinmal, Bagoda and Chitalwana Blocks of Jalore district of Rajasthan. Horns are curved & outward upward and inward pointing in orientation. Face is moderate in length and forehead is fairly broader and slightly concave. Sanchori cattle are good milk producers. Average daily milk yield, lactation milk yield and lactation length are 9.08±0.16 kg, 2769.40±48.80 kg and 9.88±0.14 months, respectively.


Sojat goat

Sojat goat

Sojat goat is large sized, dual purpose goat, distributed in Pali, Jodhpur, Nagaur and Jaisalmer districts of Rajasthan. The coat colour of these animals is white with brown spots on head, neck, ear and legs, however, pure white animals are also available in the field. Wattles are present in majority of females while completely absent in males. The horns are curved and downward oriented, twisted in females while males are completely polled. Average adult weight is about 60.0 kg in males and 53.0 kg in females. Average daily milk yield, lactation milk yield and lactation length are 1060.12±12.59 gm, 266.64±0.63 kg and 232.92±1.17 days, respectively.

Karauli goat

Karauli goats are medium to large in size and dual purpose breed, distributed in Sawai Madhopur, Kota, Bundi, and Baran districts of Rajasthan. The coat colour pattern is black with brown strips on face, ears, abdomen, legs and near pin bones. Ears in Karauli goats are long, pendulous with folded and brown lines on border of ears. The animals have roman nose. The horns are medium sized corkscrew in shape which are pointed upwards are the most typical feature of Karauli goat. Karuali bucks have prominent hanging dewlap. Average


Karauli goat

adult weight is about 52.0 kg in males and 45.0 kg in females. Average daily milk yield, lactation milk yield and lactation length are 1530.43±19.61 gm, 270.04±2.24 kg and 251.70±6.53 days, respectively.

Gujari goat

Gujari goat is large sized dual-purpose breed, distributed mainly in Jaipur and Sikar districts of Rajasthan. The animals are brown and white mixed coat colour, while white coloured face, leg and abdomen are typical features of the breed. Ears are long, pendulous and folded, and horns are small, backward and twisted. Males have beard while, it is completely absent in adult females. Dewlap is present in majority of animals. Average adult weight is about 69.0 kg in males and 58.0 kg in females. Average daily milk yield, lactation milk yield and lactation length are 1616.47±11.45 gm, 347.54±2.24 kg and 250.46±0.95 days, respectively.


Gujari goat


Banda pig

Banda pig

Banda pig is native of Jharkhand and is of black colour with short and erect ear. These animals are having medium to short bristle on neck with a long and concave snout. These are potbellied and characterized with small litter size. The average adult body weight is 28.0 kg in males and 27.0 kg in females. Average litter size is 4.5 (range 4-7) at birth and 4.25 (range 4-6) at weaning.

Manipuri Black pig

Manipuri Black pig is native of Manipur state and as the name indicates black in colour. Manipur Black pig is medium in size with flat belly and short legs. The head of these pigs is short, slightly concave with short ears, and short to medium snout. White patches are sometimes seen in extremities such as legs and snout area. Hairs are predominantly black and sparse, however few pigs with dark grey are also found. Bristle production is very scanty and cutting has not been practiced. Adult body weight averages about 96.0 kg in males and 93.0 kg in females. Average litter size is 8.27 (range 6-11) at birth and 6.02 (range 5-9) at weaning.

Wak Chambil pig

Wak Chambil is a small sized pig with round and medium pendulous belly. They are distributed in North Garo Hills, East Garo Hills, South Garo Hills, West Garo Hills and Southwest Garo Hills of Meghalaya. These pigs have small head and eyes, small erected ears, and short and pointed snout. These pigs have thick long hair on the eyebrows and over the forehead and neck. Limbs are short with small hooves that partially touches the ground. Bristles are short with high density all over the body. Pork of this breed has unique flavour and taste, thus it is utilized during special religious and ceremonial occasions. Adult body weight averages 32.0 kg in males and 29.0 kg in females. Average litter size is 5.8 (range 4-11) at birth and 4.52 (range 3-8) at weaning.


Manipuri Black pig


Wak Chambil pig

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

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

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

Horse

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

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

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

Geese

1. Kashmir Anz

Duck

1. Pati
2. Maithili

Dog

1. Rajapalayam
2. Chippiparai
3. Mudhol Hound

Characterization of native AnGR

Masilum cattle of Meghalaya

The Masilum cattle, named after the Khasi and Jaintia communities who played a crucial role in their development and conservation, have their origins in the Khasi and Jaintia Hills of Meghalaya. The Khasi language has words 'Masi' and "Lum" that means cattle and Hills, so it is called as "Masilum". They are primarily distributed in South West Khasi Hills, East Khasi Hills, East-west Khasi Hills, West Khasi Hills, Ri-Bhoi, West Jaintia Hills and East Jaintia Hills districts of Meghalaya. The utility of the cattle is Sports (Bull fighting), beef production, manure and socio-cultural festivals. Approximate population of Masilum cattle is 1.50 lakhs.

Masilum cattle is of Small size, well built, sturdy, bulky and well adapted to the hill ecosystem of the state. The body colour varies with 60% being black, 20% brown, and remaining 20 % displaying a mix of brown, grey and black. Forehead is small, broader and concave with thick tuft of hairs over the eyelids. Dewlap and hump is medium in cow while bulls have well developed dewlap and hump with tuft of hair. Horns are short mostly black (81%), grey (12%), and black with brown (7%) in colour. Udder is small with cylindrical teats and poor developed milk veins were observed. Masilum cattle have short leg, well-built hoof and towel suited for climbing hilly terrains and best fit for bull fighting thus popularly known as bull fighting cattle.

Birth weight (kg) of newborn calf ranges from 13.82 to 23.65 with an average of 18.82 (N=207) in males, whereas, in females corresponding weights (kg) range is 13.82 to 20.84 with an average of 16.76 (N=207). The average adult body weight (kg) is 192.63 (N=210) in males and 178.39 (N=210) in females. In terms of body measurements, the average chest girth, body length and height at wither were 153.7 cm, 111.9 cm and 112.6 cm, respectively in males and in females corresponding measurements were135.66 cm, 109.7 cm and 110.9 cm, respectively.

Masilum bulls during fighting (sports)

Masilum cow

The average daily milk yield, peak milk yield, lactation length, lactation milk yield, fat% and SNF% were 2.18 kg, 3.22 kg. 177.8 days, 385.56 kg, 6.19% and 8.32%, respectively. High milk fat% ranging from 6.8-8.1% was observed. The average age at first ejaculation and age at first mating were 33.24 and 36.94 months, respectively. The average age at first calving, service period and caving interval was 44.24 months, 121.48 days and 459.18 days, respectively.

Ruhelkhandi cattle of Uttar Pradesh

Initial survey for characterization of Ruhelkhandi cattle was carried out in its distribution area comprising Bareilly and surrounding districts of Ruhelkhand region of Uttar Pradesh. The coat colour of cattle is bright white. These animals are docile in nature and can be milked at any time, however usual practice of milking is morning and evening. The average milk yield is around 5 to 6 litres during a lactation period of around 7 months. The overall body length, height, chest girth, face length, face width, ear length, tail length, tail switch length, horn length, horn diameter at base, neck length and neck circumference were 131.80±1.93, 123.14 ± 2.17, 154.00± 2.000, 48.57 ± 1.74, 15.86 ± 0.77, 24.00 ± 1.73, 110.20 ± 4.62, 29.75 ± 4.49, 24.43±2.318, 16.29 ± .68, 39.50 ± 1.38 and 76.20 ± 1.59 cm, respectively. Farmers practice natural service with its own reared bull of same breed for breeding. Dams are usually docile and efficient in milk let down. Farmers prefer these *desi* cows over crossbred and exotic due to better milk quality and taste and milk is fetching good price in the market. Some cows calved upto 15th parity.

Native cattle of Udaipur Division of Rajasthan

Animal genetic resources from six districts of Udaipur Division of Rajasthan were explored to identify new populations of various livestock species. Two new populations of cattle and goat were identified. 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 153 cattle. Data on production and reproductive characteristics, and other relevant parameters were collected to characterize the identified populations.

The cattle of Udaipur division 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

Native cattle of Udaipur Division of Rajasthan

veins are not prominent. The muzzle, eyelids and tail switch are black and hooves are dark grey.

The mean values of body length, height at withers and chest girth for adult females were 93.7±0.51, 97.0±0.45 and 131.0±0.80 cm, respectively. The corresponding values for males were 97.4±1.45, 102.2±1.11 and 137.5±1.89, respectively. The estimated body weight was 149.9±2.39 kg for females and 172.5±6.98 kg for males. The Coefficient of variation was highest for horn length (30.9 %) and lowest for wither height (4.6%). Daily milk yield was 1-3 litres and milk fat content was 3-5%. Age at first breeding (female) was 4-4.5 years, while in males it was 4 years.

Native cattle populations of Tamil Nadu and Kerala

Molai Adu, Nattu Kuttai Madu, Tanjaore Kuttai Madu, Karunkanni / Thanjayur black Sattai adu are some of the non-descript AnGR of Tamil Nadu and Kasargode, Vadakara, Kurichiat, High range dwarf cattle populations from Kerala. Initial survey visit was conducted in seven villages of Aranthangi block in Pudukkottai district. All the villages visited had small population of "short-statured cattle" locally called as "Kuttai Maadu". These non-descript cattle were distributed in the region with stock density of 2-3 animals per farmer in the Pudukkottai district. They were maintained as pet animal and were utilized for traditional use such as house warming ceremonies. Indigenous non-descript cattle found at Kongahalli village in Erode district called "Kongahalli cattle", was found and interacted with the farm owner about the origin of the cattle population, management practices and breeding methods.

Kuttai Maadu cattle

Kongahali cattle

Lahuri goat of Madhya Pradesh

A homogeneous goat population namely "**Lahuri**" was identified and characterized in Chambal Division of Madhya Pradesh. The name Lahuri has been derived from "Lahu" means blood, depicting its red coat colour. The population is distributed mainly in Sabalgarh area of Morena and Vijaipur, Birpur area of Sheopur districts of Chambal Division. Several flocks of highly homogeneous goat have been observed in the region. These goats are adapted for grazing in Dang-ravines of the Chambal. In some of the region, the animals are reared under pastoral system along with Dang sheep. These goats are reared for meat purpose only and the population estimated to be around 20000. Physical and morphometric characteristics of about 120 adult animals were recorded. Various morphological parameters were recorded on 103 adult females and 14 males of Lahuri goat. It is medium type goat with an elegant look. The coat colour of the goat is shiny red on the anterior side, shoulder and fore limb, transitioning to shiny brownish to blackish on the rear part of the body. This peculiar coat is distinguishing feature of the Lahuri goat. Both sexes are horned, with highly coiled horns. Ears are exceptionally long in Lahuri goat, reaching upto 28 cm in some cases. In adult females measurements for body length, body height, heart girth, horn length, ear length and tail length were 66.50±4.55, 75.01±3.67, 79.27±5.22, 10.69±3.56, 25.10±4.21 and 17.35±3.06 cms. For adult males the corresponding measurements were 71.50±8.06, 80.07±6.80, 83.93±10.28, 16.15±5.93, 28.56±4.83 and 20.36±5.17 cms, respectively.

Lahuri goat of Chambal region (MP)

Malra goat of Ladakh

Malra is a non-pashmina goat of Ladakh. It is a medium to large size goat, are reared for meat and manure in Khaltse, Lamayuru, Lingshet, Photoksar, Skiu, Markha, villages of Leh District and in adjacent places of Kargil district. The compact body is covered with hairs which gives advantage in harsh winter climate of Ladakh. The ears are small in size and erect. The body is compact and covered with hairs. The ears are small in size and erect. The goat

Table: Morphometric parameters (in cm) of Dang sheep of Chambal region

Animal (N)	Parameter	Body length	Body height	Heart girth	Ear length	Tail length
Female (103)	Mean	66.5	71.62	83.46	19.48	35.3
	SD	4.55	4.02	4.72	2.61	5.56
Male (14)	Mean	71.5	77.29	87.43	18.86	36.29
	SD	8.06	6.87	7.79	1.21	5.94

Malra goat

is known for their disease resistance, adaptation to extreme climatic condition and good quality chevrons are important. The goat produces a small amount of Cashmere fibre (50–100 gm/animal). 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. The mean ±SE body length, Height at withers, Chest girth, Paunch girth, Face length, Face width, Head length, Ear length, Tail length (inch) were 50.40±0.67, 50.01±0.72, 62.14±0.74, 64.17±0.91, 15.22±0.26, 9.78±0.14, 20.72±0.64, 10.35±0.18, 13.67±0.22 for female and 54.91±1.31, 55.43±0.62, 66.91±1.62, 71.83±2.16, 16.50±0.32, 10.57±0,23, 24.39±1.18, 11.39±0.28, 14.43±0.45 for male animal respectively.

Sarguja goat of Chhattisgarh

Survey visit was conducted in districts of Sarguja division of the Chhattisgarh. During the visit, Takhatpur, Kota, Musturi and Bilah blocks of Bilaspur; Lormi block (including Achanakmar sanctuary) of Mungeli districts; Pali, Katghora and Pondiuproda blocks; 11 different villages of Kusmi, Shankargarh and Rajpur blocks of Balrampur district; Batauli, Lundra, Sitapur and Mainpat blocks of Surguja district; Bhaiyathan and Odgi blocks of Surajpur district; Sonhat and Baikunthpur blocks of Korea district were surveyed. Visit was also conducted in Jashpur district covering nine different villages of Bagicha, Kunkuri and Pharsabahar blocks; Gaushalas (Shakti, RaigarhPotra and Arya Vidya Sabha gaushalas) in Lailunga block of Raigarh. Five different villages of Lailunga; Gharghoda and Dharamjaigarh blocks of Raigarh and Janjgir-Champa districts were also surveyed.

Sarguja goat

Table: Morphometric parameters (in cm) of Sarguja Goat

Effect		Body Length	Height at wither	Chest Girth	Adult
Overall mean		62.12 ± 0.20	64.33 ± 0.21	73.28 ± 0.25	30.71 ± 0.16
A. District	Surajpur	62.83 ± 0.25	64.55 ± 0.25	72.67 ± 0.31	30.84 ± 0.15
	Surguja	62.35 ± 0.21	64.76 ± 0.21	73.81 ± 0.23	30.81 ± 0.15
	Balrampur	61.17 ± 0.15	63.69 ± 0.16	73.35 ± 0.23	30.47 ± 0.17
B. Sex	Male	63.82 ± 0.99	66.55 ± 0.51	75.87 ± 0.52	32.68 ± 0.27
	Female	61.5 ± 0.21	63.61 ± 0.19	72.44 ± 0.27	30.06 ± 0.16

Homogeneous goat population known as Surgujia goat was found in Bilaspur; Surajpur, Balrampur and Surguja districts with distinct phenotypes, however the same population (Anjori goat) was also observed in plains of Chhattisgarh 4) homogenous cattle population with phenotypes different from Kosali, the registered cattle breed of Chhattisgarh was present in hilly terrain of Surguja division. During the visit the phenotypic records and 121 blood samples were collected, representing pure local, Kosali breed as well as mixed type cattle (64), goat (44) (with different colour and marking pattern) and Chhattisgarhi buffalo (12). Demonstrations were conducted for the field staff of animal husbandry department regarding phenotype collection and biometric measurements.

Native goat of Udaipur Division of Rajasthan

Goats from the Udaipur Division are small and either black or reddish-brown in appearance. The females have medium conical teats and a small, pendulous 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. Fourteen biometric

Native goat of Udaipur Division of Rajasthan

Battisi goat of Uttar Pradesh

The phenotypic characterization of Batttisi goat was initiated. 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. The nose line is typical Roman type. Ears are medium to large in size, ranging from 13 to 22 cm in length. The average adult body weight ranged from 40 to 50 kg. The overall body length, height at wither, chest girth, paunch girth, face length, face width, ear length, tail length and horn length were 69.96 ±0.95, 82.33 ± 1.45 , 78.75± 1.43, 81.67 ± 1.39, 20.67 ± 0.35, 10.04 ± 0.30, 18.78 ± 0.91, 15.28 ± 0.57 and 12.43 ± 0.86 cm, respectively. Majority of the sheep farmers belong to backward communities. The goats are primarily maintained on grazing (extensive system). Goat rearing

Battisi goat

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. The primary study reveals that the Battisi goat is phenotypically different from other registered goat breeds of the region, highlighting the need for further detailed study.

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 160 goats. The mean values of body length, height at withers and chest girth for adult females were 58.6±0.31, 65.5±0.29 and 69.0±0.35cm, respectively. The body weight of does was 25.6±0.34 kg. The Coefficient of variation was highest for horn length (24.7 %) and lowest for rump height (4.7 %). Daily milk yield was 300-500 ml. Age at first breeding (female) was 10-12 months, while in males it was 8-10 months. Data on production and reproductive characteristics, and other relevant parameters were collected to characterize the identified populations.

Dang sheep of Madhya Pradesh

Dang sheep is distributed in Bhind, Morena and Shopur districts of Chambal division of Madhya Pradesh, with high density in ravine (Dang) region of Chambal River. The population consist of more

Morphometric parameters (in cm) of Dang sheep of Chambal region

Animal (N)	Parameter	Body length	Body height	Heart Girth	Ear length	Tail length
Female	Mean	64.55	71.62	83.46	19.48	35.3
	SD	3.52	4.02	4.72	2.61	5.56
Male	Mean	70.43	77.29	87.43	18.86	36.29
	SD	4.69	6.87	7.79	1.21	5.94

Dang sheep

than 10000 animals and is highly homogeneous, reared under specific production system. Many of the sheep flocks are reared under pastoral system and graze in dry and arid highland ravines. The name has also been derived from the region, where these sheep are reared. These sheep are mainly reared for meat production.

The sheep are medium sized, although smaller than sheep breeds of adjacent areas of Rajasthan. The wool is of medium thickness, dense, and slightly curly. Body colour is creamish white with brownish patches on face. Ears are leafy and folded from midline. Tail is medium in length but does not reach beyond hock. It is thick at origin and tapered at the end. Morphological parameters were recorded for 87 adult females and 7 males of Dang sheep. In adult females the measurements for body length, body height, heart girth, ear length and tail length were 64.55±3.52, 71.62±4.02, 83.46±4.72, 19.48±2.61, 35.30±5.56 cms,respectively. For adult male the corresponding measurements were 70.43±4.69, 77.29±6.87, 87.43±7.79, 18.86±1.21, 36.29±5.94 cms, respectively. Average adult weight in females was estimated to be 35.13 Kg.

Malluk sheep

Malluk sheep of Ladakh

A lesser known sheep found mostly in Lingshet, Photoksar, Skiu, Markha, Lamayuru, Khaltse and Hanu area of Leh district as well as some parts of Zanskar block in the Kargil district. Animals are small to medium in size, with long pointed flat head. The animals are known for their disease resistance, sturdiness, and prolificacy. Majority of the coat colour is white; however, animals with shades of black are also present. Their head feature short, slightly tubular dropping ears and curved downwards horns. Head and ears are usually brown with white patches on forehead extending up to nostrils however animals with black head are also present. The lower portion of legs near hoof is brown. Body is covered with relatively fine fleece and their faces and legs are covered with small hairs. Malluck sheep are reared under semi-intensive system and valued for their production of good quality wool for cloth and carpet industry. These sheep co-exists with pashmina goats for thousands of year and act as a protector of weak animals from severe winter when housed together. In adult female the

measurement of Body length, Height at withers, Chest girth, Paunch girth, Face length, Face width, Horn length, Ear length, Tail length (cm) were 48.39±0.76, 51.41±0.69, 61.29±0.84, 64.91±0.91, 15.56±0.22, 10.35±0.14, 15.26±0.82, 9.51±0.20, 12.28±0.23, respectively. The corresponding measurements in males were 52.68±0.74, 55.62±0.69, 67.88±1.07, 69.21±1.31, 16.45±0.24, 10.33±0.13, 18.93±0.98, 10.08±0.22, 13.75±0.33, respectively.

Wak Chambil Pig of Meghalaya

Wak Chambil pigs are distributed in North Garo Hills, East Garo Hills, South Garo Hills, West Garo Hills and South West Garo Hills districts of Meghalaya. They were developed by Garo tribal community residing in Garo Hills. The approximate population of this breed is 43405. The body colour in males is pure black with white patches at extremities, while females have pure black colour with grey or white patches at extremities. This is the smallest pig breed with compact body among the local indigenous pigs in the North east region of India. Snout is slightly concave and bristle are short . These pigs have small head and eyes, small erected ears with short pointed snout and thick long hair on the eyebrows, forehead and neck. Limbs are short with small hooves that partially touches the ground, making them unique among other pig breeds. In both the sexes, the top line was almost straight and gradually developed concavity with advancing age. Short and high-density bristles over the body are the unique feature as compare to other indigenous pig breeds. Round and medium pendulous belly resembles to shape of the *Citrus macroptera*f ruit. Pork has unique flavour and taste, making them popular during special religious and ceremonial occasions.

The average chest girth, body length, height at wither and neck girth are 17.12 cm, 17.15 cm, 12.26 cm and 13.16 cm in males and 17.43 cm,17.22 cm,12.52 cm and 13.64 cm in females, respectively. The average age at first mating in males and females were 204.8 days and 239.82 days, respectively. Average litter size at farrowing and weaning were 5.8 (ranging from 4-11) and 4.52(ranging from 3-8), respectively. The average litter weight is 2.75 kg (ranging from 1.8 to 2.9 kg). The average age at slaughter is 300 days, and dressing percentage ranges from 68 to 69% in males and 64 to 66% in females. Average fat % in males and females is 28.08% and 32.58%, respectively. Slaughter weight in males and females are 31.43 kg and 28.42 kg, respectively.

Wak Chambil Pig

Indigenous poultry genetic resources of Tripura

The survey was conducted to study the indigenous chicken population of West Tripura, Gomati, Sepahijala, Khowai and Dhalai districts in Tripura state. During the survey, phenotypic characters, reproduction performance, utility and management practices of about 180 local chicken were recorded from 73 farmers maintaining about 2000 birds, through a survey questioner developed for the characterization of Indian chicken. The native chickens are mostly raised under semi-intensive system of rearing, where they are fed with broken rice and kitchen waste.

The plumage pattern in most of the birds are of spotted type with varying plumage colors from brown, black, white etc., and varying degrees of spotting. Their tail feathers are sickle shaped. More than 95% of the birds were having medium to large sized red colored single comb. Around 73% of the surveyed birds have yellow shank while the remaining have grey to greyish yellow shank. All the birds have clean shank without feathers. The annual egg production ranged from 40 to 45 eggs with laying period ranges from 12 to 15 days. The age at first egg ranges from 12 to 16 months with three clutches in a year with brooding. When the birds are not allowed for brooding the number of clutch may increase up to four in a year, but most of the farmers allow the hens for brooding. Many farmers allow the hens for brooding of duck eggs also.

Farmers reported 40-50% chick mortality within first week which gradually decreases as the age advances. Diseases like Ranikhet disease, Infectious Bursal Disease, enteritis and Salmonella were found to be more prevalent among the chickens. Birds are provided with housing only during night time. The local indigenous chicken population is having admixture of plumage colour and plumage pattern and does not have homogeneity in phenotypes. Hence, cannot be categorized as a separate unique population/breed.

Indigenous poultry genetic resources of Tripura

Chang-Khi dog of Ladakh

Changthang is a part of the high altitude Tibetan Plateau in the south eastern part of Ladakh, with vast highlands and giant lakes. Changthang is home to the Changpa, a nomadic Tibetan people. The people of the Changthang are semi-nomadic pastoralists, they are known as 'Changpa', or 'Champa'. Dog (*Canis lupus familiaris*) is the first animal domesticated by human being and has been most widely kept as guarding, hunting and pet animal, belongs to subspecies of gray wolf (*Canis lupus*), a member of the Canidae family of the mammalian order Carnivora. Indian breeds are mainly utilized for guarding the farm, farm house and shepherding livestock during grazing, migration and hunting. Since ages, the livelihood of Changpa nomads in Changthang is entirely dependent upon livestock rearing such as Ladakhi yak, Ladakhi cattle, Changthangi sheep and Changthangi goat. These nomads also rear native dogs known locally as Changkhi dog as watch dog to guard their livestock including Changthangi sheep and Changthangi goat from wild animals and other predators and also for their safety. Survey visits were conducted in Changthang area of Ladakh to characterize indigenous shepherd dog populations reared by Changpa nomads. Due to various demographic factors, in recent times its population size is declining very fast. Two types of coat colours were observed viz. one with complete fawn or light brown colour and animals with complete black coat with fawn or brown patches around eyes and face.

Chang-Khi dog

The bitches attain sexual maturity at an age of about 12-14 months and usually mating is not preferred during the first heat. The age at first whelping is about 20 months. The male dogs reach sexual maturity between 12-16 months. Most of the breeders do not sell puppies instead it is being given as gift to friends and other close relatives who can provide proper care. Most of the breeders maintain their dogs with non-vegetarian food. Few breeders used to sell their puppies at a rate ranging from Rs. 4,000 to 5,000 according to the demand. The primarily utility of these dogs is mostly guarding/staking/herding the Changthangi sheep and goat breeds of the nomadic people of Changthang region. This unique canine germplasm is an integral part of Changpa nomads of Changthang region of Ladakh needs to be documented and registered at National level.

Morphometric parameters (cm) of Chang-Khi dog

Parameters (in cm)	Mean ± SE (N= 100)
Height at withers	63.99±0.45
Height at base of the tail	61.85±0.54
Body length	69.59±0.79
Chest girth	71.98±0.70
Paunch girth	65.37±0.57
Head width	10.14±0.18
Snout length	09.24±0.11
Head length	17.52±0.22
Neck length	16.36±0.40
Neck girth	51.30±0.42
Ear length	10.75±0.59
Ear width	09.79±0.71
Tail length	34.56±0.34
Body weight (kg)	25.93±0.36

Eki dog of Arunachal Pradesh

A homogeneous native dog **"Eki"** was identified as potential population in the region. It is distributed across the Upper Siang, East Siang, Siang, Lower Dibang Valley districts. Eki dog is medium-sized, with body height of about 44 cm. The coat colors are mainly reddish or cream; either uniformly distributed or along with white or light patches. Dogs with grey or black coat are also present. The face has a peculiar wolf like appearance with a small, tapering and triangular shape and erect ears. It is reared mainly by the Adi and Nishi along with other communities for sniffing, tracking the Mithun and guarding houses. Population of these dogs is estimated between 5000-10000. Data on various physical, morphometric, production and reproduction traits on 52 native Eki dog were collected.

Combai dog of Tamil Nadu

A survey visit was conducted to study the Combai dog in various villages of southern Tamil Nadu, including Madurai, Thuthookudi, Kayalpattinam, Thenni, Thevaram, Kombai, Cumbum, Usilampatti, Kalaiyarkovil and Ponnamaravathy. These dogs are believed to be originated from a village called Combai in Theni district of Tamil Nadu. They are predominantly kept as a guard dog for agriculture field and farm houses as well and can be found fairly distributed throughout Tamil Nadu.

The majority of Combi dogs have short coat with coat colour ranging from reddish brown colour to light brown with a black muzzle and nostrils. A small percentage of animals (approx. 1-2 %) exhibit brindle coat colour. Ears are medium in size with most of the animals having drooping or semi-drooping ears. Eyes-golden color -97.8% & 2.2%-black, Nail no- FL-5+5 & HL-4+4 (98.7%), while FL- 5+5 & HL-5+5 (1.3%).

Animals are vaccinated regularly with 7 in one or 9 in one vaccine. They are fed a non-veg diet consisting ofchicken/mutton offal & egg.The tail is long, tapering and slightly curved at the distal end. They are known for alertness, high aggression levels and loyalty to their owner. Owners take great pride in maintaining Combai dogs, who are primarily utilized for guarding agricultural farms and farmhouses. . There is very high demand for Combai puppies and they are sold at a price ranging from Rs 15,000 to 30,000 per pair and needs to be documented and registered at National level.

Combai dog

Table: Morphometric parameters (cm) of Combai dog

Parameters	Mean ± SE (N=105)
Height at withers	54.14±0.42
Hight at Base of tail	53.79±0.45
Body Length	52.62±0.38
Chest girth	63.03±0.42
Pouch girth	48.64±0.60
Head width	11.87±0.44
Snout length	9.16±0.16
Head length	19.84±0.37
Neck length	15.07±0.39
Neck girth	36.99±0.31
Tail length	32.41±0.27
HFL_Right	16.55±0.19
HFL_Left	16.17±0.18
LHLL_Right	21.14±0.60
LHLL_Left	21.02±0.74
UHLL_Right	20.08±0.23
UHLL_Left	20.27±0.26
FFL_Right	11.33±0.29
FFL_Left	10.99±0.34
LFLL_Right	18.68±0.35
LFLL_Left	18.45±0.42
UFLL_Right	17.44±0.24
UFLL_Left	17.29±0.28
Body weight	18.64±0.31

Uniformity assessment of Livestock Population

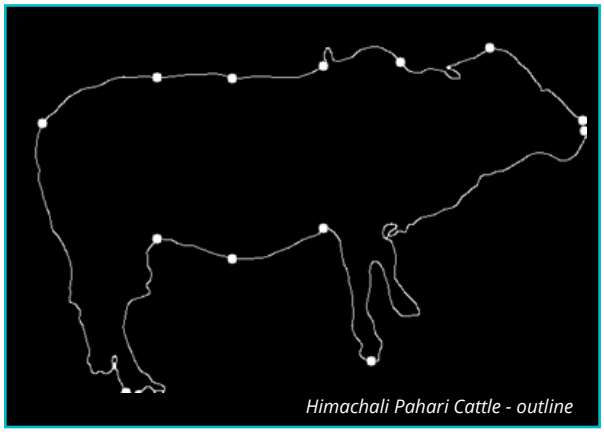
To explore the methods of segmentation and phenotyping of animals from photographs, a comprehensive literature of review was conducted. Most of the methods used animal photographs taken in a specific setting of cameras and background under farm conditions. As we envisaged obtaining photographs from field settings, the computational pipeline proposed by Nye et al. (2020) in their publication Frontier in Genetics was used. The source-code in Python language for Mask R-CNN model and unsupervised image segmentation were downloaded from online resources. Additionally, the necessary Python packages were also installed on our computer. Model parameters were fine-tuned. Animal photographs of cattle and sheep available in the AnGR database at our institute were utilized as trial to segment the animal images. Extreme points in image outline were identified to obtain phenotypic measurements. Photographs

Rampur hound dog of Uttar Pradesh

Initial survey was conducted for characterization of Rampur Hound dog in the villages of Rampur & Suar area located in the Rampur district. During the survey phenotypic characters, body biometry (26 traits), management practices followed for 22 Rampur hound dog (20 adult animals & 2 puppies) were recorded. The Rampur hound dog is exclusively used as a guarding dog. During the survey in the Rampur district the team could able to trace only few breeders maintaining this breed and the same was confirmed through interaction with veterinary officers and Rampur hound dog breeders. Even though the population size of Rampur hound dog is less, it may be registered as an extant breed, which will protect the legal rights of the breeders and also to popularize the breed among the breeders and government organization to open Rampur hound kennels for conserving this unique canine germplasm.

Rampur hound dog

Himachali Pahari Cattle



Himachali Pahari Cattle - outline

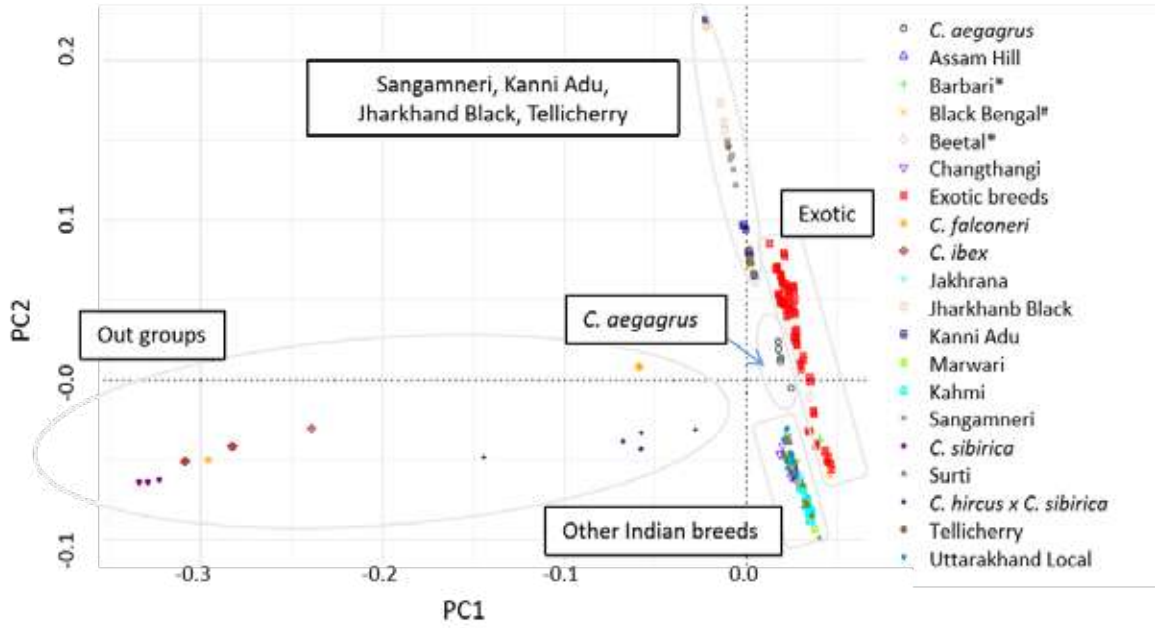
with contrasting animal and background colours provided good segmentation.

Admixture analysis of Cattle

For the admixture mapping study, a total of 192 DNA samples were collected, with 21 from each population. The samples represent 9 distinct cattle populations, namely Gangatiri, Bachaur, Purnea of Bihar, Shahabadi of Jharkhand, and Khamgaon, Gaolao, nondescript and crossbred cattle of Maharashtra. Genotyping was performed using GGP 50k SNP chip. The genome studio software was used for initial quality checks of the genotyped data as well as to generate map and ped files. The average call rate was 93% and 185 samples out of 192 were genotyped for more than 85% of the SNPs. A total of 73,763 SNP positions were genotyped and after applying a minor allele frequency (MAF) of 0.05, 49,786 SNPs were retained for further analysis. The average MAF found to be 0.33 and heterozygosity proportion of 0.40. Population structure using Principal component analysis (PCA) revealed clear difference between the cattle population of Bihar and Jharkhand region (Gangatiri, Bachaur, Purnea and Shahabadi) and those of Maharashtra (Khamgaon, nondescript, Gaolao and crossbred).

Genomic diversity in Indian goat

A comprehensive analysis was conducted on a total of 203 whole genome resequencing samples, consisting of 102 samples from 11 Indian native goat breeds/populations, 101 goat samples from 30 exotic goat breeds including 5 wild goats outgroups. The average number of read per sample varied from 181.38M in Tellicherry to 217.24M in Surti, with an overall average of 201.93M reads. Quality control assessment showed high quality data with Q20 with Q30 scores averaging 96.64% and 92.23%,respectively. The GC content, average duplication rate and coverage was 43.05%, 17.26%, and 99.20%, respectively. The average depth of coverage ranged between 8.37x in Jharkhand Black to 9.27x in Surti. The average number of SNPs identified, retained after quality filtration and retained after LD filtration were 20495988.45, 2720152.182, and 769656.8182, respectively. The breed specific SNPs and INDELs were most abundant in Kanni Adu (1.5million and 3.4million, respectively) while lowest in Jharkhand Black (24000 and 1.1million). LD analysis revealed that LD decayed below 0.2 within 10kb distance for all breeds, except for Jharkhand Black, Sangamneri and Tellicherry which exhibited higher LD levels indicating, highest inbreeding coefficient in these breeds. The other diversity estimates in Jharkhand Black also had the lowest proportion



PCA of worldwide Goat breeds (-samples taken from Pakistan, #-samples taken from Bangladesh)*

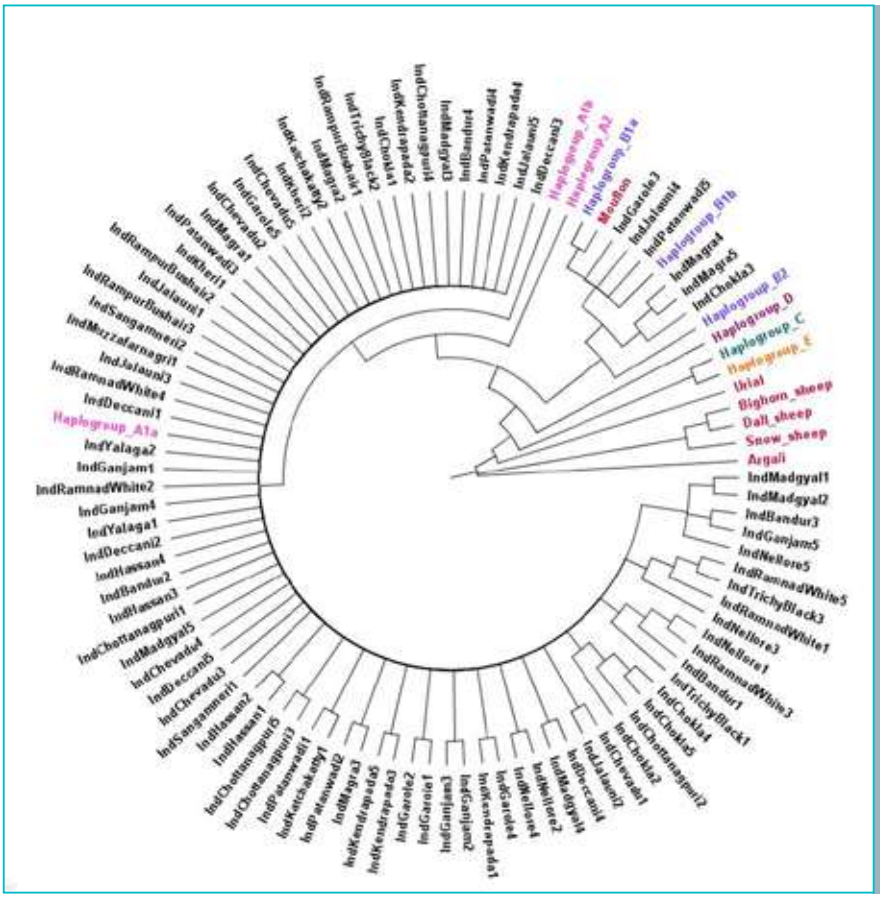
of polymorphic SNPs, as well as Observed and Expected heterozygosity (0.025384717, 0.119386783 and 0.268691964, respecitvely) conversly Changthangi had the highest Observed and Expected heterozygosity (0.505419684 and 0.378952256, respectively). The PCA showed that the animals of Jharkhand Black, Kanni Adu, Sangamneri and Tellicherry are very distinct from the other breeds when compared with other Indian and Exotic breeds along with wild species. It is also interesting to see the close genetic relationship between wild progenitor of domestic goat *Capra aegagrus* and *Capra hircus* individuals.

The selection signatures were found for each of the four breeds compared to all the other breeds using 5 different methods: Nucleotide diversity (θπ), Composite likelihood ratio (CLR), Tajima'D statistic, Fixation Index (F_{ST}), Cross Population-Extended Haplotpe Homozygosity (XP-EHH). The statistics were combined using Decorrelated Composite of Multiple Signals (DCMS) to find genes that were selected. The analysis revealed 53 genes that were selected across four breeds. Thease genes play important roles in various biological functions like milk production (B4GALT1), fertility (PRLR, PRP6), DNA replication, methylation, and damage repair (CMPK1; SIRT1; and ACTB, FTO, SP1, FOXM1, respectively), immunity (SLAMF1, RORA), heat stress alleviation (HSF1) and tumour suppression (TNF).

Mitogenome genetic diversity of Indian sheep

Mitochondrial DNA (mtDNA) analysis is a widely used approach for assessing the maternal diversity, phylogeny, and population structure of livestock species. D loop and cytochrome b genes are the most extensively exploited regions of the mitogenome for unraveling molecular diversity and domestication events. The advent of next generation sequencing technologies has opened vistas for elucidating the evolutionary relationships at the genome wide scale. The

complete mitochondrial genome sequences of 88 Indian sheep representing 22 breeds/populations (Bandur, Chevadu, Chokla, Chotanagpuri, Deccani, Ganjam, Garole, Jalauni, Katchaikatty Black, Kendrapada, Kheri, Hassan, Madgyal, Magra, Muzaffarnagari, Nellore, Patanwadi, Ramnad White, Sangamneri, Tiruchi black, Yalaga, and Rampur Bushair) were analyzed for the first time to get a comprehensive picture of the maternal diversity in the sheep genetic resources of India. The mitochondrial DNA sequence of all Indian sheep was observed to be 16617 bp long and contained 37 genes, including 13 protein coding genes, 2 rRNA genes, 22 tRNA genes, and a control region. With the exception of NAD6 gene and eight tRNA genes, all other genes were encoded on the heavy strand of the mitogenome. Sequence analysis of all 88 samples yielded a total of 84 novel haplotypes in Indian sheep, with an overall haplotype diversity (Hd) value of 0.999, and nucleotide diversity (π) equal to 0.00183. The AMOVA analysis between the four separate clusters representing northern temperate, southern peninsular, eastern and north-western arid and semi-arid regions attributed maximum genetic variance within the clusters and less variance between the clusters. Phylogenetic relationships of Indian sheep was explored with five established ovine haplogroups (A-E) as well as wild sheep, which revealed clear separation of domestic sheep from the wild ones. Indian sheep showed conformity to haplogroups A and B reported across the world.



Phylogeny of mitogenomes of Indian breeds in relation to known ovine haplogroups

Network Project on Animal Genetic Resources

Network project on Animal Genetic Resources (AnGR) was initiated in the year 1996 for creating network of various agencies working in the area of AnGR management. The primary focus of Network Project on AnGR is comprehensive characterization of AnGR of the country across all the states and UTs, so as to complete AnGR mapping of India. Earlier populations were considered as units but during the current plan period, all the populations of livestock and poultry present in various states would be characterized.

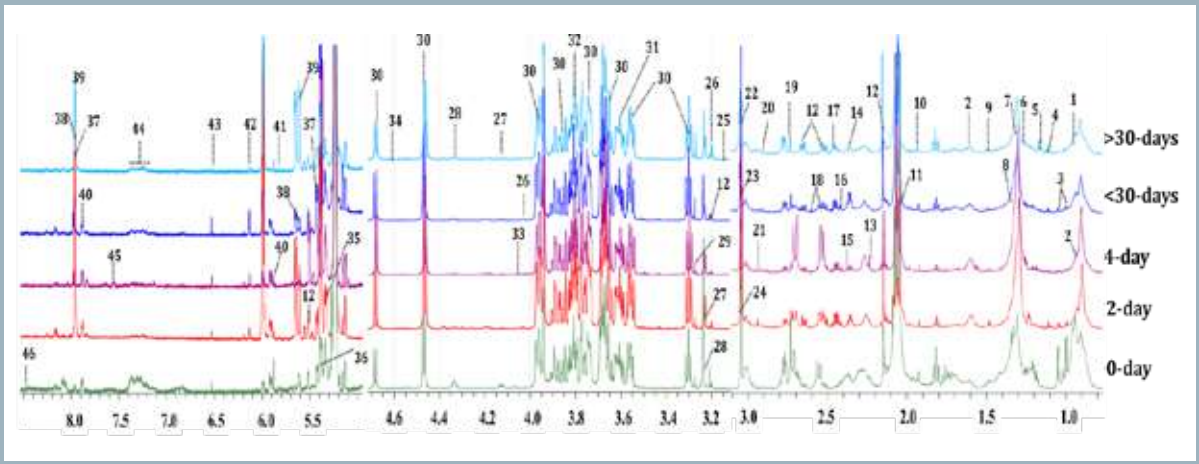
During 2022-23 only 3 centers (Bihar, Maharashtra and Arunchal Pradesh) were initiated, as in these three states quick survey has been completed with the collaborating agency of the state. The populations identified are being characterized in detail following systematic survey with standardized questionnaires.

Evaluation and trait characterization of native AnGR

Metabolome analysis of Ladakhi cow's colostrum

The present study was conducted under DST project. The native cows of Ladakh are unique and well-adapted to high altitude hypobaric hypoxia conditions. As these native cows thrive in its native environment by grazing local grasses and herbs therefore, an effort was made to unravel metabolome signature of colostrum, transition and mature milk of these cows. A total of 40 defatted and lyophilized colostrum (0-day: N=10), transition milk (2-day: N=10; 4-day: N=10) and mature milk (<30-days: N=6; >60 days: N = 12) samples were analyzed using ^{1}D 1H 800 MHz NMR spectroscopy. The representative NMR spectra showing different metabolites is shown in **Fig 1**. In total, 46 metabolites from 8 different classes such as organic acids (Betaine; Creatine; cis-Aconitate; Guanidoacete; Fumate; Formate Citrate; Oxoglutarate; Pyruvate; Succinate; 3-Hydroxybutyrate); amino acids (Glycine;; Glutamate; Phenylalanine; Alanine; Threonine; Isoleucine; Leucine; Valine); organic nitrogen compounds (Carnitine; Dimethylamine; Choline; Trimethylamine); Carbohydrates (N-Acetyl-D-glucosamine; Lactulose; lactose, maltose); Nucleic acids (Uridine diphosphate-N-acetylglucosamine; Uridine; Uridine diphosphategalactose; dCTP), Benzenoids (myo-Inositol; Hippurate; sn-glycero-3-phosphocholine); Fatty Acyls (Acetate; Isobutyrate; Acetylcarnitine; Pyruvate; Succinate) and; Organic oxygen compounds (Acetone) were detected.

Amongst 46 metabolites, 31 metabolites showed significant differences ($p<0.01$) in their concentration across colostrum (0-day), transition (2-&4-day) and mature milk (<30-&>30-days) (**Fig.2**). Several of these metabolites showed highest enrichment in colostrum (0-day) while their levels declined gradually in transition to mature milk samples. Some of the most abundant metabolites present in colostrum samples were; UPD-galactose, O-phosphocholine, myo-inositol, N-acetyl glucosamine, UDP-glucose, betaine. The UPD-galactose concentration was highest (3016.76 ±362.66 µM) in colostrum and in subsequent days its level reduced significantly to 846.24±78.93 µM in 2-day transition milk; 648.12±68.16 µM in 4-day transition milk, 492.47±62.93 µM in <30-days, and 318.75±87.49 µM in >30-days of lactation. Similarly, O-phosphocholine level was also high in colostrum (1648.23±67.47 µM), followed by 2-day (1550.34 ± 126.3 µM), 4-day (1375.26 ± 75.1 µM), mature milk of <30-days (983.68± 74.1 µM) and mature milk of >30-days (783.55± 77.3 µM). Myo-inositol was another major metabolite that showed highest concentration in colostrum (1523.44± 21 µM), 747.83±91.16 µM in 2-day, 590.55±41.60 µM in 4 day, 569±74.68 µM in <30 days, 511.20±81.38 µM in >30-days of milk samples. UDP-glucose level was also highest in colostrum (1385.48±76.18 µM) followed by 917.71±51.70 µM in 2-day, 536.69±52.28 µM in 4-day, 519.80±61.42 µM in <30-days, and 371.58±146.93 µM in >30-days of lactation. A total of 8 amino acids were identified with a varying concentration in colostrum, transition and mature milk samples of Ladakhi cows. Most of the amino acids showed maximum abundance in colostrum samples followed by 2-day, 4-day, <30-days and >30-days mature milk.



^{1}H chemical shift (ppm)

Fig 1. 800-MHz ^{1}H NMR spectra of colostrum (0-day), transition (2-&4-day) and mature milk (<30-&>30-days) of Ladakhi cows. The individual metabolites are labeled as: 1: Isoleucine; 2: Leucine; 3: Valine; 4: Isobutyrate; 5: 3-Hydroxybutyrate; 6: Fucose; 7: Threonine; 8: Lactate; 9: Alanine; 10: Acetate; 11: N-Acetylglucosamine; 12: O-Acetylcarnitine; 13: Acetone; 14: Glutamate ; 15: Pyruvate; 16: Succinate; 17: Carnitine; 18: Citrate; 19: Dimethylamine; 20: Trimethylamine; 21: 2-Oxoglutarate; 22: Creatine; 23: Creatine phosphate; 24: Creatinine; 25: Malonate; 26: Choline; 27: O-Phosphocholine; 28: sn-Glycerophosphocholine; 29: Betaine; 30: Lactose; 31: Glycine; 32: Guanidoacetate; 33: myo-Inositol; 34: Lactulose; 35: Maltose; 36: Glucose-1-Phosphate; 37: UDP- N-Acetylglucosamine; 38: UDP-Galactose; 39: UDP-Glucose; 40: Uridine; 41: cis-Aconitate; 42: dCTP; 43: Fumarate; 44: Phenylalanine; 45: Hippurate ; 46: Formate

Interestingly, the present data set has shown presence of high level of three branched chain amino acids (valine, leucine, isoleucine) in the colostrum of Ladakhi cows. Amongst all the amino acids, threonine was the most abundant amino acids across all the time points. The higher amount of BCAAs as recorded in colostrum samples of present study hold great promise. Such findings will be helpful in adding value to Ladakhi cow colostrum. Amongst all the clusters, the colostrum group was found to be highly distinct, indicating that the concentration of various metabolites in colostrum were quite different than that of 2-day, 4-day, and mature milk (<30-days; > 30-days). Some of the metabolites having most discriminating power (high VIP score>1.5) to differentiate these 5 groups with high were: UDP-galactose, UDP-glucose, citrate, creatine phosphate, myo-inositol, lactose, 2-oxoglutarate, valine, maltose, leucine, dimethylamine, and choline. (**Fig 3B**).

The PCA results showed separate groupings of 0-day (colostrum), 2-day, 4-day (transition milk), <30-days and >30-days (mature milk). The partial least squares discriminant analysis (PLS-DA), also discriminated samples belonging to 0 day (colostrum), 2- day and 4- day as well as <30-days and >30-days and clustered separately (Fig. 3A).

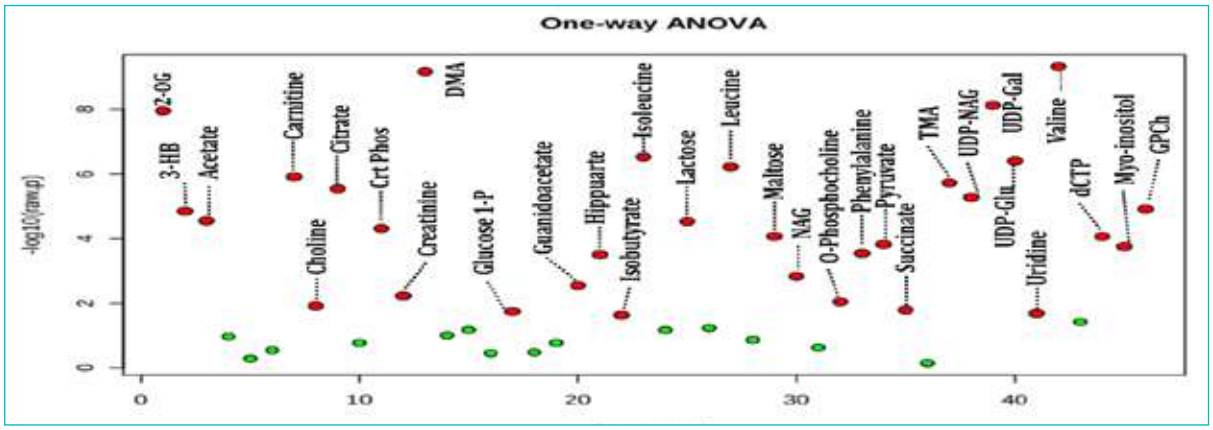


Fig.2*: Metabolites showing significant differences (p<0.01) in concentration across colostrum (0-day), transition (2-&4-day) and mature milk (<30-&>30-days) of Ladakhi cows.*
Red dots: significant differences across groups; Green dots: non-significant differences across groups

The hierarchical clustering of colostrum, transition and mature milk samples based on individual metabolite concentration is shown in **Fig.3C**. The 0-day colostrum was distinctly different while, 2-day and 4-day samples clustered together. Similarly, <30-days and >30-days samples of mature milk grouped together indicating similarity in their metabolic profile. Overall analysis indicated that colostrum metabolome of Ladakhi cows was quite dynamic in nature where in large number of metabolites concentrations dropped from 0-day to transition (2-day and 4-day) and mature milk (<30-days and >30-days).

The fold change and Log2 (FC) values for different metabolites between 0-day vs 2-day; 0-day vs 4-day; 0-day vs <30-days and 0-day vs >30-days is

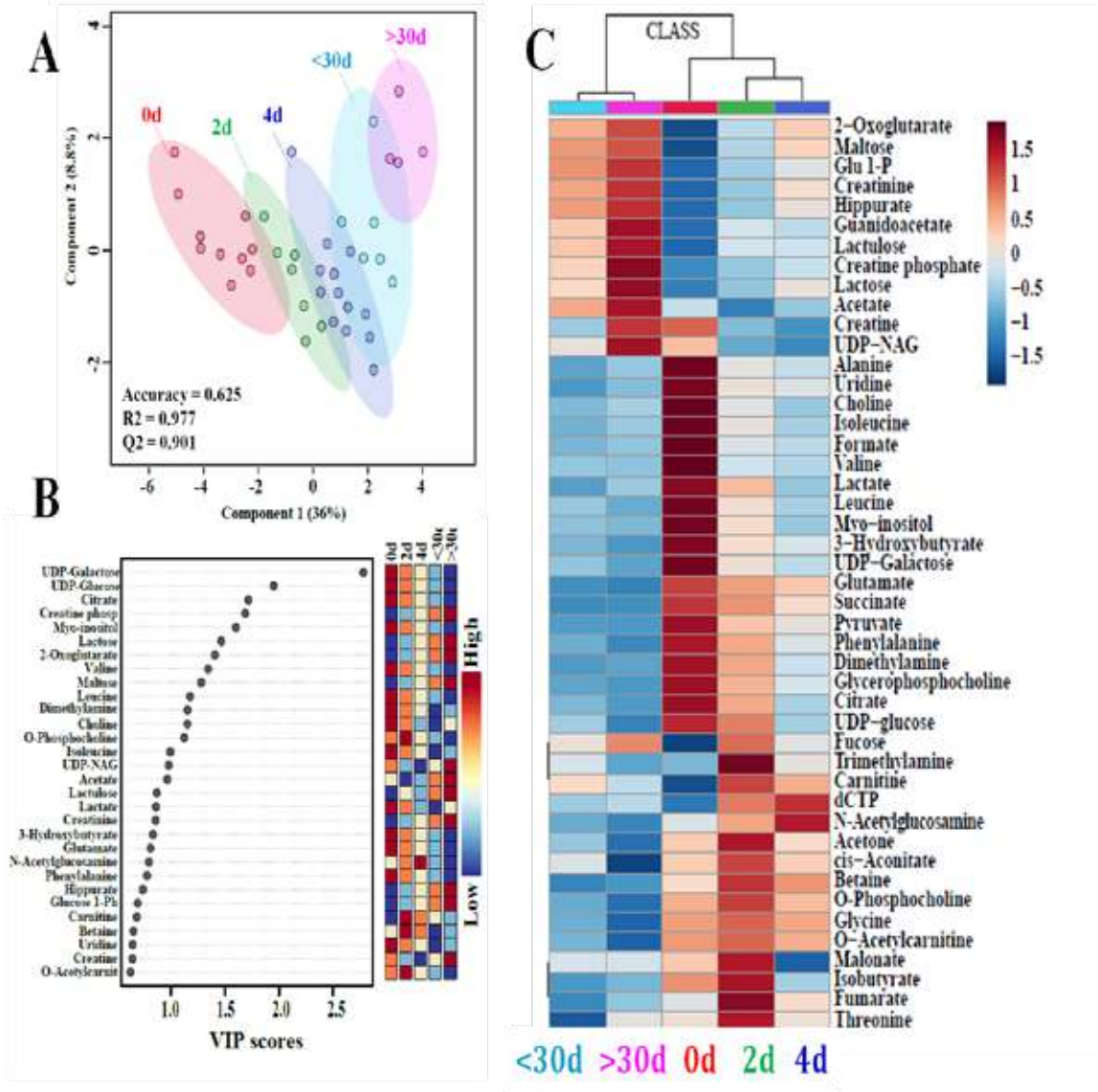


Fig 3: **(A)** *The 2D PLS-DA score plot showing separate clustering of colostrum (0-day), transition (2-&4-day) and mature milk (<30-&>30-days) of Ladakhi cows. The colored ovals represent 95% confidence intervals for each group.* **(B)** *The VIP score indicating metabolites with most discriminating power for separating samples in 5 groups.* **(C)** *Hierarchical clustering of colostrum, transition and mature milk samples based on individual metabolite concentration.*

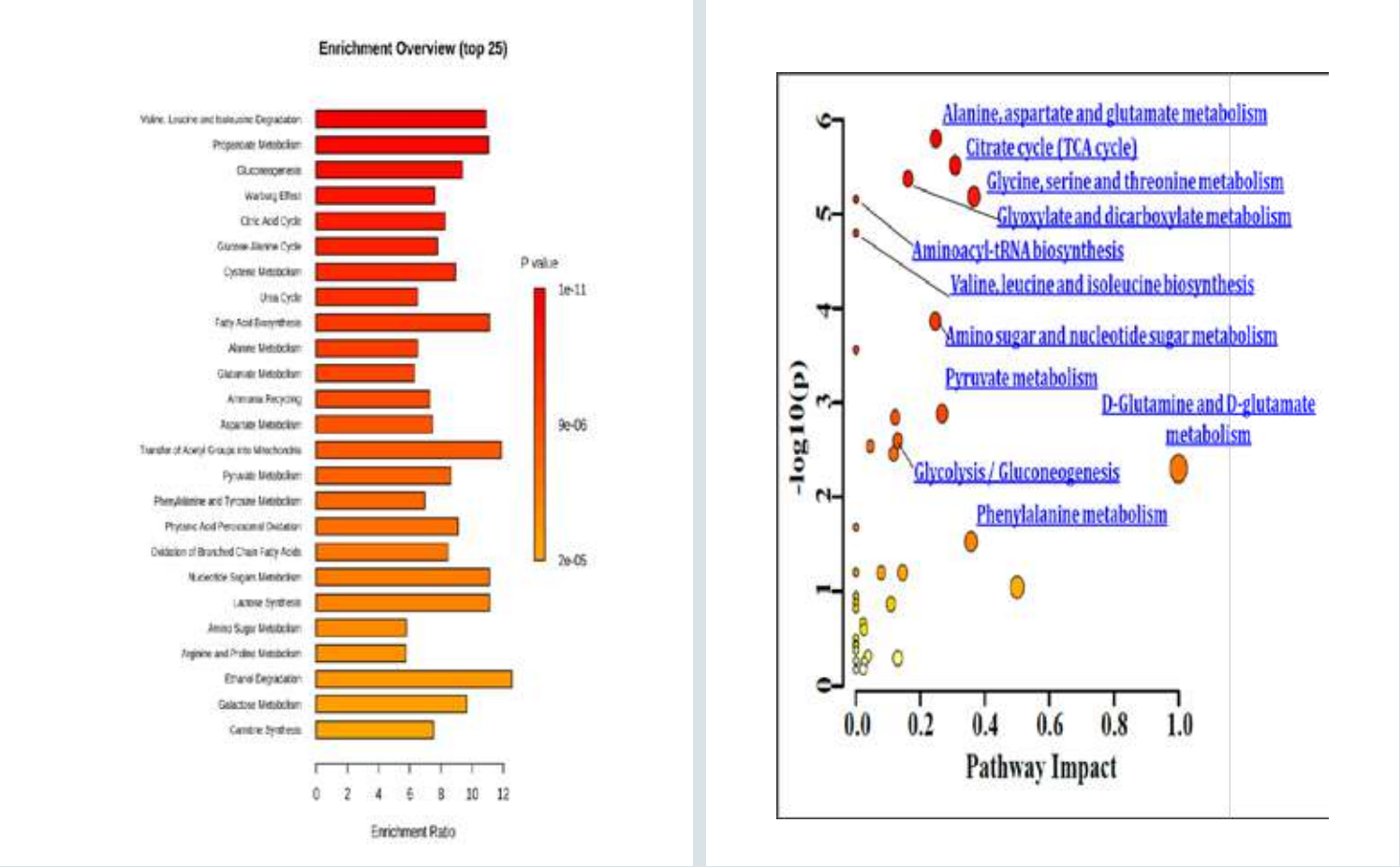


Fig.4 A): *Quantitative enrichment analysis of metabolites from colostrum and mature milk of Laadakhi cows,*
B): *Pathways impacted in the data set. Nodes that are red colour depict significance at p<0.05 and size of the nodes depict the impact.*

summarized in Table-1. As expected, maximum differences in metabolite concentration were observed between colostrum and mature milk (>30-days). UDP-galactose (FC=9.5), valine (FC=8.9), isoleucine (FC=5.4), phenylalanine (FC=5.3), leucine (FC=5.0), dimethylamine (FC=5.0), Sn-glycerophospholipid (FC=4.8), citrate (FC=4.7), 3-hydroxy butyrate (FC=4.0) were some of the most differentiating metabolites between colostrum and mature milk.

The enrichment analysis identified top 25 metabolite encriched terms upon comparing the metabolome data of colostrum and mature milk **(Fig.4A)**. Some of the enriched terms were: valine, leucine and isoleucine degradadtion, propionate metabolism, gluconeogenesis, citric acid cycle, glucose alanine cycle, cysteine metabolism, urea cycle, fatty acid synthesis etc. The pathways most impacted in the data set were; Alanine, aspartate and glutamate metabolism; Aminoacyl-tRNA biosynthesis; Amino sugar and nucleotide sugar metabolism; citrate cycle (TCA cycle); Butanoate metabolism; Glyoxylate and dicarboxylate metabolism; Arginine and proline metabolism: Pyruvate metabolism etc. The pahthways and their impact values are depicted in **Fig.4 B**. The indepth information on these metabolic pathways will provide better understanding on overall regulation of metabolic meachnaism operational during early lactation phases of Ladakhi cows. The high content of several metabolites in colostrum might be playing cruicial role in the growth and development of newly-born calves in high altitude envrionment. In future, such type of information will play cruicial role in depicting the neutrceutical properties of colostrum and milk of Ladakhi cows mostly reared under extensive grazing sytem.

Table 1: The fold change differences in metabolite concentration between 0-day vs 2-day; 0-day vs 4-day; 0-day vs <30-days and 0-day vs >30-days

S.N	Name	FC/ log2(FC)	FDR	S.N.	Name	FC/ log2(FC)	FDR
0-day vs 2-day							
1	Valine	5.5/2.5	0.0004	10	Myo-inositol	2.7/1.4	0.0024
2	UDP-Galactose	3.6/1.8	0.0012	11	UDP-glucose	2.7/1.4	3.82E-05
3	Isoleucine	3.3/1.7	0.0001	12	Pyruvate	2.7/1.4	0.0003
4	Leucine	2.7/1.4	0.0000	13	Succinate	2.7/1.4	0.0031
5	UDP-NAG	2.4/1.3	0.0014	14	Choline	2.3/1.2	0.0003
6	3-Hydroxybutyrte	2.2/1.1	0.0013	15	Uridine	2.1/1.0	0.0014
7	Acetate	2.2/1.1	0.0013	16	Maltose	0.5/-1.1	0.0089
8	Myo-inositol	2.1/1.1	0.0076	17	Creatine phosphate	0.5/-1.1	0.0214
9	Carnitine	0.3/-1.6	0.0000	18	Hippurate	0.5/-1.1	0.0009
10	Trimethylamine	0.3/-1.9	0.0002	19	Carnitine	0.4/-1.2	0.0761
0-day vs 4-day				20	Lactose	0.4/-1.4	0.0095
1	Valine	6.4/2.7	1.55E-06	21	2-Oxoglutarate	0.3/-1.6	0.0001
2	Isoleucine	4.8/2.3	7.32E-08	**0-day vs >30-days**			
3	UDP-Galactose	4.7/2.2	2.02E-06	1	UDP-Galactose	9.5/3.2	0.0021
4	Leucine	3.6/1.9	1.49E-10	2	Valine	8.9/3.2	0.0023
5	Citrate	3.3/1.7	2.02E-06	3	Isoleucine	5.4/2.4	0.0008
6	UDP-NAG	2.9/1.5	7.68E-05	4	Phenylalanine	5.3/2.4	0.007
7	Dimethylamine	2.8/1.5	1.68E-06	5	Leucine	5.0/2.3	2.08E-07
8	Glycerophosphocholine	2.7/1.4	0.00019	6	Dimethylamine	5.0/2.3	0.0008
9	UDP-glucose	2.6/1.4	7.32E-08	7	Glycerophosphocholine	4.8/2.3	0.0021
10	Myo-inositol	2.6/1.4	1.47E-05	8	Citrate	4.7/2.2	0.0021
11	Phenylalanine	2.5/1.3	0.00042	9	3-Hydroxybutyrte	4.0/2.0	0.0010
12	3-Hydroxybutyrte	2.4/1.3	3.97E-06	10	UDP-glu	3.7/1.9	0.0003
13	Choline	2.2/1.1	9.86E-07	11	Myo-inositol	3.0/1.6	0.0064
14	Lactose	0.5/-1.1	0.001909	12	Pyruvate	3.0/1.6	0.0010
15	Carnitine	0.4/-1.4	1.68E-06	13	Succinate	2.8/1.5	0.0078
16	2-Oxoglutarate	0.4/-1.5	4.05E-06	14	Choline	2.4/1.2	0.0007
0- day vs <30-days				15	Glutamate	2.3/1.2	0.0073
1	Valine	8.4/3.1	0.0003	16	cis-Aconitate	2.3/1.2	0.0007
2	UDP-Galactose	6.1/2.6	0.0004	17	Uridine	2.2/1.1	0.0074
3	Isoleucine	5.4/2.4	0.0001	18	Acetone	2.1/1.1	0.0045
4	Dimethylamine	4.7/2.2	0.0001	19	O-Phosphocholine	2.1/1.1	0.0002
5	Citrate	4.2/2.1	0.0003	20	Lactate	2.1/1.1	0.0042
6	Glycerohosphocholine	3.9/2.0	0.0041	21	Maltose	0.4/-1.3	0.1299
7	Leucine	3.7/1.9	3.12E-07	22	Hippurate	0.4/-1.3	0.0009
8	Phenylalanine	3.4/1.8	0.0055	23	Creatine phosphate	0.3/-1.9	0.0021
9	3-Hydroxybutyrte	3.0/1.6	0.0003	24	2-Oxoglutarate	0.3/-1.9	0.0023

Metabolome signatures of Biofluids of Ladakhi Yak

The Yak (*Bos grunniens*) is as an iconic livestock animal of high altitude. The yak in Ladakh is a multi-purpose animal and lifeline of local community and nomads. In the present study, metabolic profiles of various biofluids collected form Ladakhi yak such as milk (Fig.5), serum (Fig.6), saliva (Fig.7), urine (Fig.8), and faeces (Fig.9) were generated by nuclear magnetic resonance technique (^{1}H-NMR). A total of 249 metabolites were identified across the five biological fluids. Out of these, only 8 metabolites were common across all biofluids. Rest of the metabolites were either present uniquely or partially overlapped across different biofluids. Some of the major metabolites identified in serum of yak were: lactate (576.1 ± 200.8), glucose (454.6 ± 211.3), acetate (124.7 ± 40.2); glycine (77.1+24.9) and alanine (56.2+19.7); in milk of yak, the major metabolites were: lactose (160087 ± 84134.81), sn-Glycerophosphocholine (862 ± 367.96), O-phosphocholine (775.7 ± 306.8), creatine (712.1 ± 376.4), and N-acetylglucosamine (703.6 ± 244.4); in saliva of yak, the major metabolites were: lactose (201.4 ± 407.9), methanol (112.8 ± 130), acetone (53.5± 50.1); acetate (46.6± 33) and lactate (38.1± 26.4); in urine of yak, the major metabolites were: hippurate (19488.7 ± 21132), urea (10859.1 ± 9287.1), creatinine (3955.2 ± 2957.5), glycolate (3416.66 ± 609.3) and N-phenylacetylglycine ((3019.4 ± 2389.2); in fences of yak the major metabolites were: acetate (217.9 ± 28.7), propionate (42.2 ± 5.29), lactate (25.2 ± 25.5) methanol (23.1 ± 6.9) and. butyrate (14.3 ± 2.6). The present data has provided information about the metabolomic signatures of individual biofluids of Ladakhi yak adapted to high altitude and will serve as a reference guide to understand the yak biological system more comprehensively.

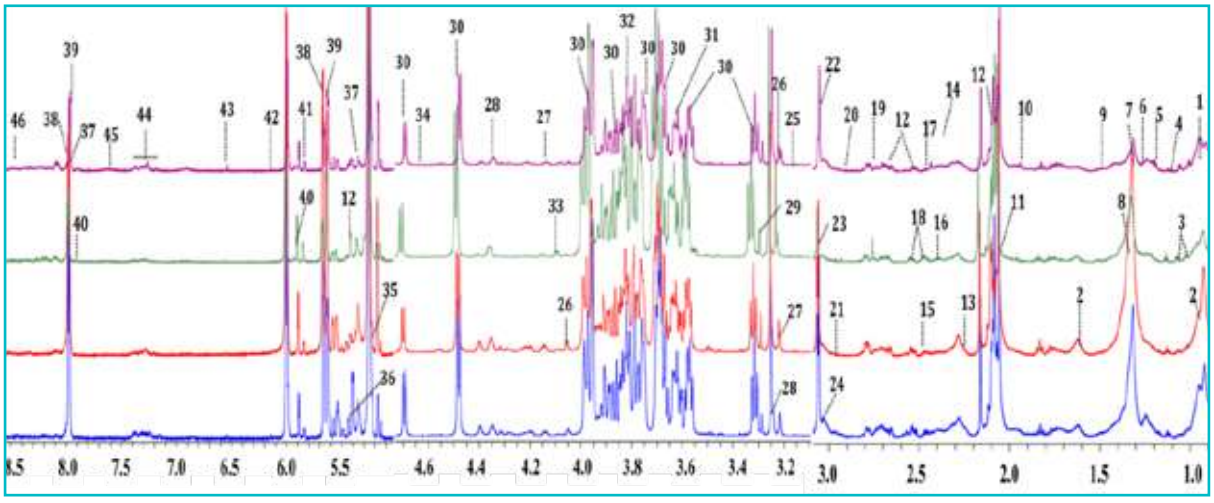


Fig. 5: Ladakhi yak milk *1: Isoleucine; 2: Leucine; 3: Valine; 4: Isobutyrate; 5: 3-Hydroxybutyrate; 6: Fucose; 7: Threonine; 8: Lactate; 9: Alanine; 10: Acetate; 11: N-Acetylglucosamine (NAG); 12: O-Acetylcarnitine; 13: Acetone; 14: Glutamate ; 15: Pyruvate; 16: Succinate; 17: Carnitine; 18: Citrate; 19: Dimethylamine; 20: Trimethylamine; 21: 2-Oxoglutarate; 22: Creatine; 23: Creatine phosphate; 24: Creatinine; 25: Malonate; 26: Choline; 27: O-Phosphocholine; 28: sn-Glycerophosphocholine; 29: Betaine; 30: Lactose; 31: Glycine; 32: Guanidoacetate; 33: myo-Inositol; 34: Lactulose; 35: Maltose; 36: Glucose-1-Phosphate; 37: UDP-NAG; 38: UDP-Galactose; 39: UDP-Glucose; 40: Uridine; 41: cis-Aconitate; 42: dCTP; 43: Fumarate; 44: Phenylalanine; 45: Hippurate ; 46: Formate*

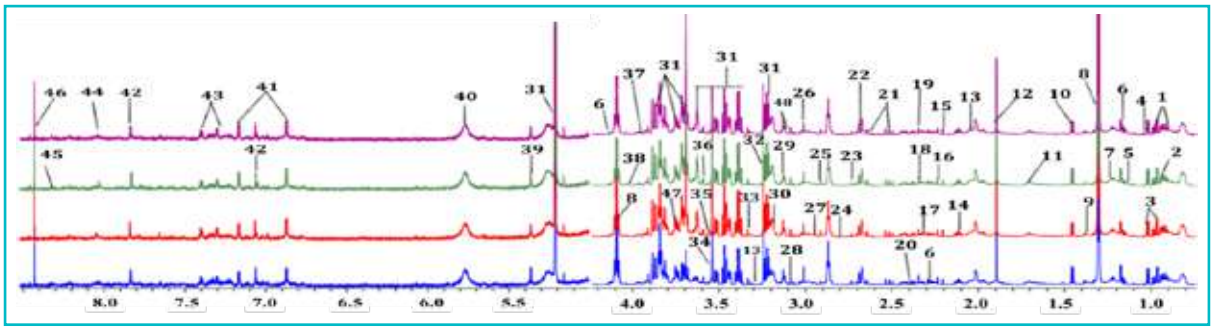


Fig.6: Ladakhi yak serum: 1: Isoleucine; 2: Leucine; 3: Valine; 4: Isobutyrate; 5: Ethanol; 6: 3-Hydroxybutyrate; 7: Methylmalonate; 8: Lactate; 9: 2-Hydroxyisobutyrate; 10: Alanine; 11: Arginine; 12: Acetate; 13: Proline; 14: Methionine; 15: Acetone; 16: Acetoacetate; 17: Glutamate; 18: Pyruvate; 19: Succinate; 20: Glutamine; 21: Citrate; 22: Dimethylamine; 23: Sarcosine; 24: Aspartate; 25: N,N-Dimethylglycine; 26: Creatine; 27: Creatine Phosphate; 28: Dimethyl sulfone; 29: Choline; 30: sn-Glycerophosphocholine; 31: Glucose; 32: Betaine; 33: Methanol; 34: Glycine; 35: Glycerol; 36: Threonine; 37: Serine; 38: myo-Inositol; 39: Allantoin; 40: Urea; 41: Tyrosine; 42: Histidine; 43: Phenylalanine; 44: 3-Phenylpropionate; 45: NADPH; 46: Formate; 47: Guanidoacetate; 48: Malonate

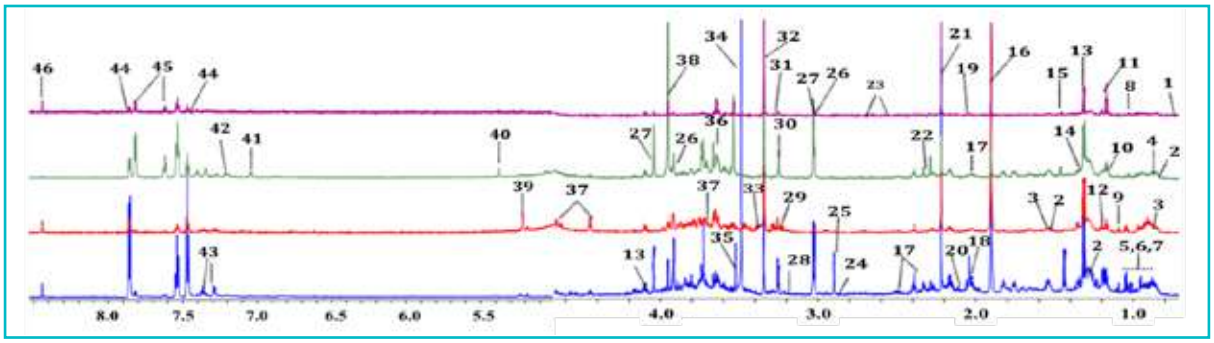


Fig.7: Ladakhi yak saliva 1: Cholate; 2: Caprate; 3: Butyrate; 4: 2-Hydroxyvalerate; 5: Isoleucine; 6: Leucine; 7: Valine; 8: Propionate; 9: Isobutyrate; 10: Isopropanol; 11: Ethanol; 12: 3-Hydroxybutyrate; 13: Lactate; 14: 2-Hydroxyisobutyrate; 15: Alanine; 16: Acetate; 17: Pyroglutamate; 18: N-Acetylglycine; 19: N-acetylglucosamine; 20: Methionine; 21: Acetone; 22: Acetylsalicyclate; 23: Citrate; 24: 3,5-Dibromotyrosine; 25: N,N-Dimethylglycine; 26: Creatine; 27: Creatinine; 28: O-Phosphocholine; 29: O-Acetylcholine; 30: Choline; 31: sn-Glycerophosphocholine; 32: Trimethylamine N-Oxide; 33: Betaine; 34: Methanol; 35: Glycine; 36: Ethylene glycol; 37: Lactose; 38: Glycolate; 39: Maltose; 40: Sucrose; 41: Gallate; 42: Tyrosine; 43: 2-Phenylpropionate; 44: Benzoate; 45: Hippurate; 46: Formate.

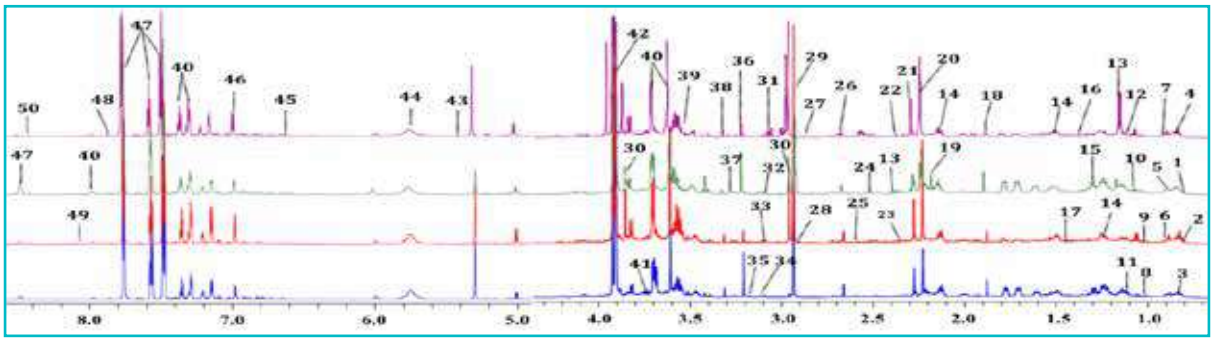


Fig.8: Ladakhi yak urine 1: Caprate; 2: 2-Octenoate; 3: 3-Methyl-2-oxovalerate; 4: Butyrate; 5: Isoleucine; 6: Leucine; 7: Valine; 8: Isobutyrate; 9: Methylsuccinate; 10: Propylene Glycol; 11: Ethanol; 12: 3-Aminoisobutyrate; 13: 3-Hydroxybutyrate; 14: Azelate; 15: Lactate; 16: 2-Hydroxyisobutyrate; 17: Alanine; 18: Acetate; 19: Acetone; 20: Acetoacetate; 21: Acetylsalicyclate; 22: Pyruvate; 23: 4-Pyridoxate; 24: Citrate; 25: Methionine; 26: Dimethylamine; 27: N,N-Dimethylformamide; 28: Trimethylamine; 29: Creatinine; 30: Creatine; 31: cis-Aconitate; 32: Malonate; 33: Dimethyl sulfone; 34: O-Acetylcholine; 35: Betaine; 36: Trimethylamine N-oxide; 37: 1,3-Dimethylurate; 38: Methanol; 39: Glycine; 40: N-Phenylacetylglycine; 41: Guanidoacetate; 42: Glycolate; 43: Allantoin; 44: Urea; 45: Fumarate; 46: Gallate; 47: Hippurate; 48: Xanthine ; 49: Adenine; 50: Formate

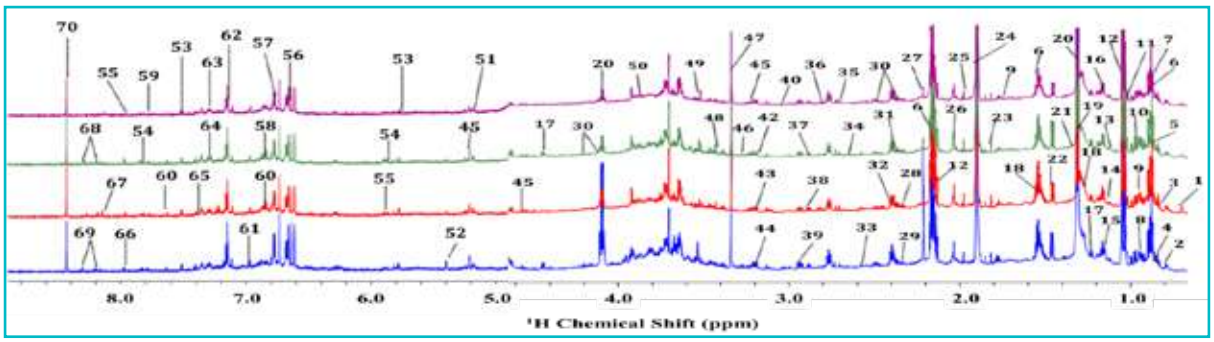


Fig.9: Ladakhi yak faeces 1: Cholate; 2: 2-Hydroxyisovalerate; 3: 2-Hydroxybutyrate; 4: 2-Octenoate; 5: Valerate; 6: Butyrate; 7: Isovalerate; 8: Isoleucine; 9: Leucine; 10: Valine; 11: Isobutyrate; 12: Propionate; 13: Propylene glycol; 14: Isopropanol; 15: Ethanol; 16: 3-Hydroxybutyrate; 17: Fucose; 18: Azelate; 19: Suberate; 20: Lactate; 21: 2-Phenylpropionate; 22: Alanine; 23: Thymine; 24: Acetate; 25: Acetamide; 26: N-Acetylglucosamine; 27: Acetone; 28: Proline; 29: Pyruvate; 30: Pyroglutamate; 31: Succinate; 32: 3-Hydroxy-3-methylglutarate; 33: Methylamine; 34: Aspartate; 35: Dimethylamine; 36: Methylguanidine; 37: Trimethylamine; 38: N,N-Dimethylglycine ; 39: N-Methylhydantoin 40: Malonate; 41: Choline; 42: O-Phosphocholine; 43: O-Acetylcholine; 44: sn-Glycerophosphocholine; 45: Glucose; 46: Betaine; 47: Methanol; 48: Glycine ; 49: Ethylene glycol; 50: Serine; 51: Trehalose; 52: Sucrose; 53: Uracil; 54: 2'-Deoxyuridine; 55: Guanosine; 56: 3,4-Dihydroxybenzeneacetate; 57: 3-Hydroxyphenylacetate; 58: Tyrosine; 59: 4-Hydroxybenzoate; 60: Methylhistidine ; 61: 4-Hydroxyphenylacetate ; 62: 3-Hydroxyphenylacetate; 63: Phenylacetate ; 64: Phenylalanine ; 65: 2-Phenylpropionate ; 66: 2'-Deoxyguanosine; 67: Oxypurinol ; 68: 2'-Deoxyinosine ; 69: Inosine ; 70: Formate.

Immunological and antimicrobial properties of Ladakhi bovines milk

The native cattle and yak populations of Leh-Ladakh are naturally adapted to hypobaric hypoxia condition prevalent in highland plateau. These two livestock species have been the integral component of daily life of rural as well as nomadic populations of Ladakh region. In the present study, an effort was made to estimate the concentration of Immunoglobulins (IgG1, IgA, IgM) and two major whey proteins with antimicrobial properties (Lactoferrin and Lysozyme) and growth factor (insulin growth factor) in colostrum, mature milk (60-90 days) of Ladakhi cows (LAC) and yak (LAY) using bovine specific ELISA kits. For comparison with lowland cattle, the samples of Sahiwal cows (SAC) were also included. A total of 80 samples belonging to 0 day (colostrum, n=20), 2 day (transition milk, n=20), 4 day (transition milk, n=20) and >30 days (mature milk, n=20) of LAC, LAY and SAC were included. The analysis of data showed that concentration of IgG1 was maximum in colostrum samples across LAC, LAY and SAC. The IgG1 concentration in 0-day colostrum samples were; 36.17 mg/ml, 17.6 mg/ml and 51.83 mg/ml in LAC, LAY and SAC, respectively. Its level reduced substantially in mature milk samples (60-90 days) across the three animal types. The IgG2 level in colostrum of LAC, LAY and SAC were; 145.18 mg/ml, 148.80 mg/ml and 156.21 mg/ml, respectively. Similar to IgG1, its level reduced substantially in mature milk samples

The IgA level was also highest in colostrum samples across LAC (479.90 ng/ml), LAY (483.84 ng/ml) and SAC (500.05 ng/ml) and its level also declined in subsequent days of lactation. The IgM concentrations in colostrum samples of LAC (2939.60 ng/ml), LAY (5411.36 ng/ml) and SAC (4392.69 ng/ml) also showed the similar trend as observed for IgG1, IgG2 and IgA. Additionally, the lactoferrin concentration in the 0-day samples were: LAC (642.51 ng/ml), LAY (647.07 ng/ml) and SAC (558.03 ng/ml). The lysozyme concentration was also relatively high in colostrum samples **(**LAC:1144.16 ng/ml, LAY:1117.72 ng/ml, SAC:1173.59 ng/ml), and then slightly reduced in mature milk. In contrary, the lactoperoxidase level was high in mature milk as compared to colostrum across all the three populations. Its level in colostrum of LAC (2155.79 ng/ml), LAY (2492.86 ng/ml and SAC (2531.91 ng/ml), was relatively on lower side as compared to mature milk. Such kind of studies will be helpful in quantifying various biomolecules, growth factors and immunomodulators in milk and colostrum of native animals for their utilization and value addition.

Ladakhi cow

Ladakhi demo (Yak)

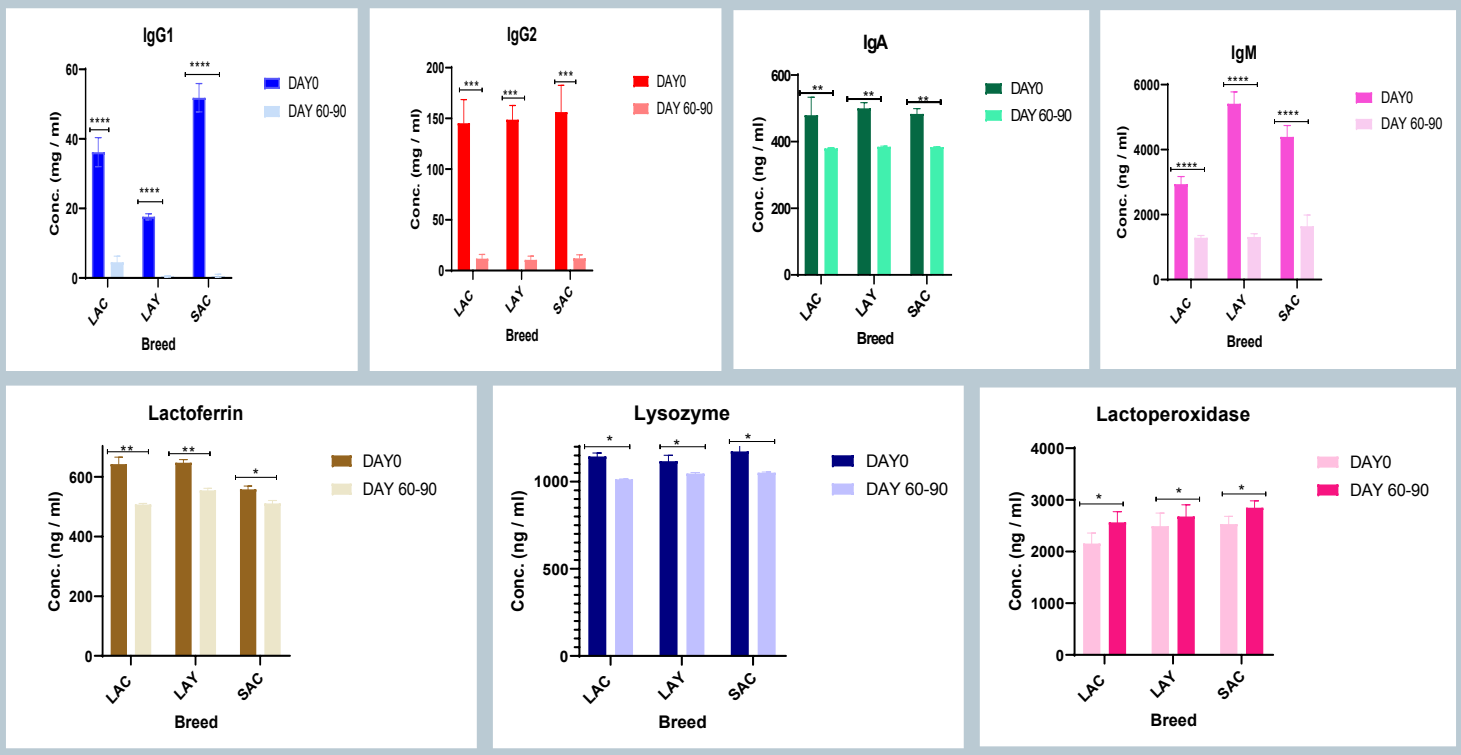


Fig: *Relative abundance of various biomolecules in colostrum and mature milk of Ladakhi cows (LAC), Ladakhi yak (LAY) and Sahiwal cows (SAC) *P<0.05; **P<0.01, ***P<0.001*

Characterization of milk exosomes of native cattle

A study was conducted to investigate the distribution of essential metabolites in Karan Fries (crossbreed of Sahiwal and Holstein Friesian) cows, as well as cows of indicine origin (Sahiwal) and taurine origin (Holstein Friesian). For the purpose, milk samples were collected from Sahiwal, Holstein Friesian and Karan Fries cows and exosomes were extracted using the ultracentrifugation method. The confirmation of morphology and size range was performed through transmission electron microscopy (TEM) and nanoparticle tracking analysis (NTA,) respectively (Fig 1).

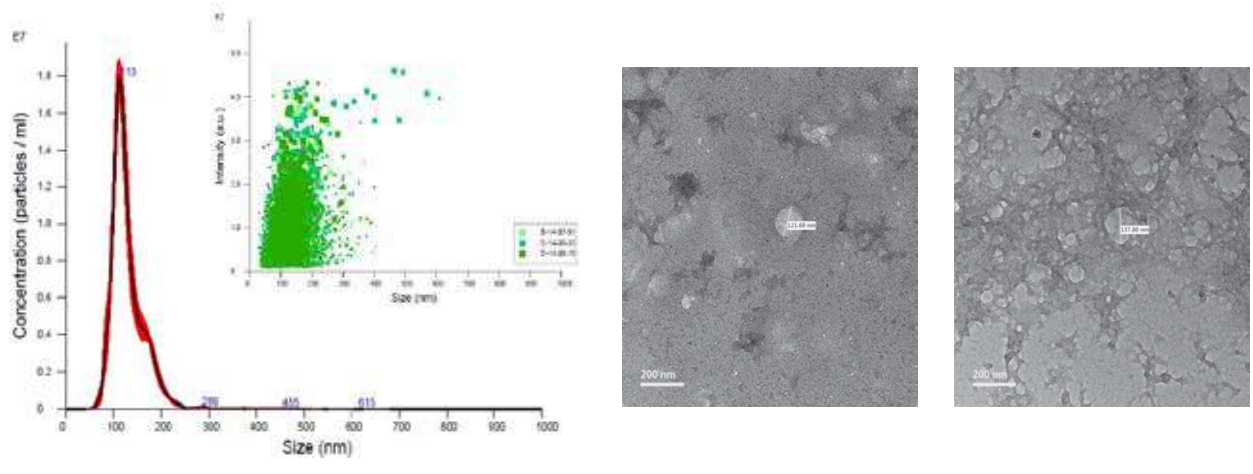


Fig 1: *A. Size distribution of Milk Derived Exosomes by NTA B. Biophysical characterization of Milk Derived Exosomes by TEM*

For Metabolite quantification and profiling involved the generation of 1H-NMR data using 800 MHz Bruker Ultrashield Plus NMR spectrometer. The data acquisition was conducted in a blinded manner to ensure unbiased results. The one-dimensional spectra were acquired using the Bruker 1D proton spectroscopy pre-saturation pulse sequence. Initial specimens were sized to ensure the half-height line width of approximately 0.7–0.8 Hz for the DSS peak calibrated to 0.0 ppm. 1H-NMR spectra were phased manually followed by baseline correction. The profiler module of ChenomX was used to profile 1H-NMR spectra for metabolite identification and quantification using a non-targeted approach. In NMR spectroscopy, chemical shifts in NMR spectroscopy are measured in parts per million relative to a reference resonance signal from a standard molecule.

A total of 41 metabolites were identified in milk derived exosomes (MDE) from 1H-NMR spectroscopy data and most of these were comprised of amino acids, organic acids, sugars, organic compounds and nucleic acids. Among them, 23 metabolites were differentially regulated (≤0.05 p-value) between the Indicus, taurine and crossbred MDE samples (Fig 2-3). These differentially regulated metabolites included

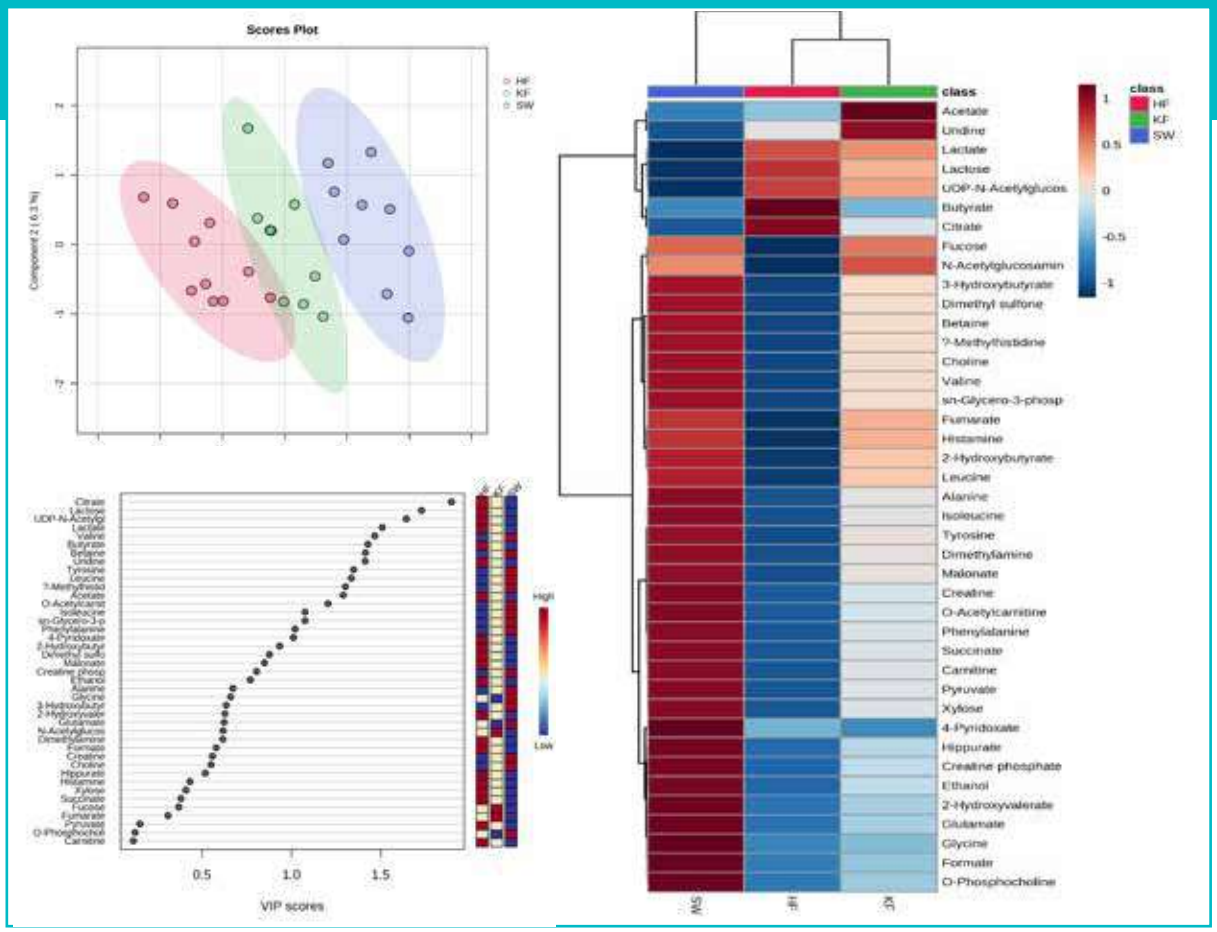


Figure 2 (A-C): *2D PLS-DA score plot derived from the analysis of CPMG 1H NMR spectra of Sahiwal, HF and KF milk derived exosomes. The coloured ovals represent the 95% confidence intervals for each group* **(2A)**. *Heatmap of MDE metabolites in Sahiwal, crossbred taurine cows. Each column represents a sample group, and each row represents a metabolite* **(2B)**. *VIP score plot used to identify the metabolite entities responsible for the discrimination MDE from different sources* **(2C)**.

Betaine, Dimethyl sulfone, Acetate, Glycine, O-Acetylcarnitine, 2-Hydroxybutyrate, Malonate, Ethanol, Lactose, Butyrate, Creatine phosphate, sn-GPCh, UDP-N-Acetylglucosamine, Valine, Phenylalanine, Creatine, Carnitine, Formate, Citrate, N-Acetylglucosamine, Leucine, Glutamate, Xylose. NMR dataset was first subjected to principal component analysis (PCA) to detect for any outliers and later partial least squares discriminant analysis (PLS-DA) was carried out. The resulting score plots revealed clear grouping of samples as per the cow type that is indicine, crossbred or exotic (Fig. 2A). The PLS-DA score plots indicated that all the clusters were well separated from each other with minor overlapping. The goodness-of fit parameters of PLS-DA model showed high R2 and Q2 values indicating high predictive accuracy in classification of different groups and reliability of model. The hierarchal heat map clustering also showed separate clustering of MDE based on source (Fig 2B). The metabolites that were having most discriminating power to differentiate these 3 groups were also identified on the basis of variable importance in projection (VIP). The metabolites showing VIP score with >1.20 were considered to have highest discriminative power. Some of the metabolites with high VIP score were found to be citrate, lactose, UDP-NAG, betaine lactate, uridine and butyrate. Most of these metabolites primarily contributed to the differentiation between indicine and taurine MDE while minimal changes were observed in crossbred MDE (Fig 2C).

MDE derived metabolite pathways by using Kyoto Encyclopedia of Genes and Genomes (KEGG) enrichment analysis indicated that differentially regulated metabolites play significant role in the pathways involved in various metabolic processes like Aminoacyl-tRNA biosynthesis, TCA (citrate) cycle, phenylalanine-tyrosine and tryptophan biosynthesis, Glyoxylate and dicarboxylate metabolism, Glutathione metabolism as well as pathways like Ras-MAP kinase involved in VEGF signalling.

The up-regulated metabolites in the Sahiwal MDE were mainly enriched in significant pathways including alanine, arginine and proline, glycine, serine, phenylalanine, tyrosine metabolism, glucose-alanine cycle and urea cycle. Others were valine, leucine and isoleucine degradation as well as oxidation of branched chain fatty acids as well as “ammonium recycling” metabolisms. On the other hand, metabolites enriched in HF MDE were involved in the pathways like Warburg effect and vitamin B6 metabolism (Fig 3).The study provided information on the metabolome of MDE and sheds light on the probable role of identified metabolite in promoting positive health attributes.

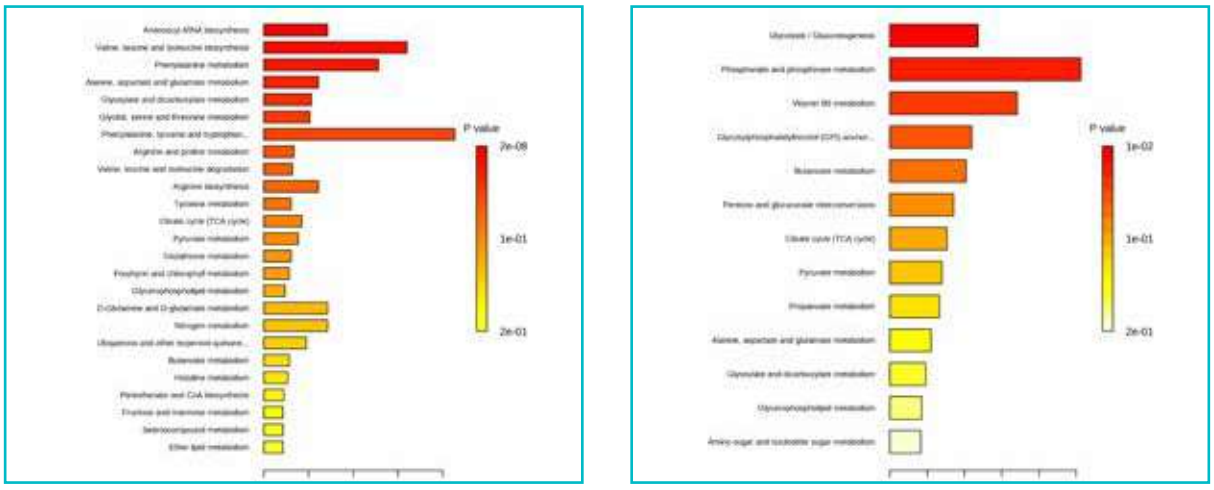
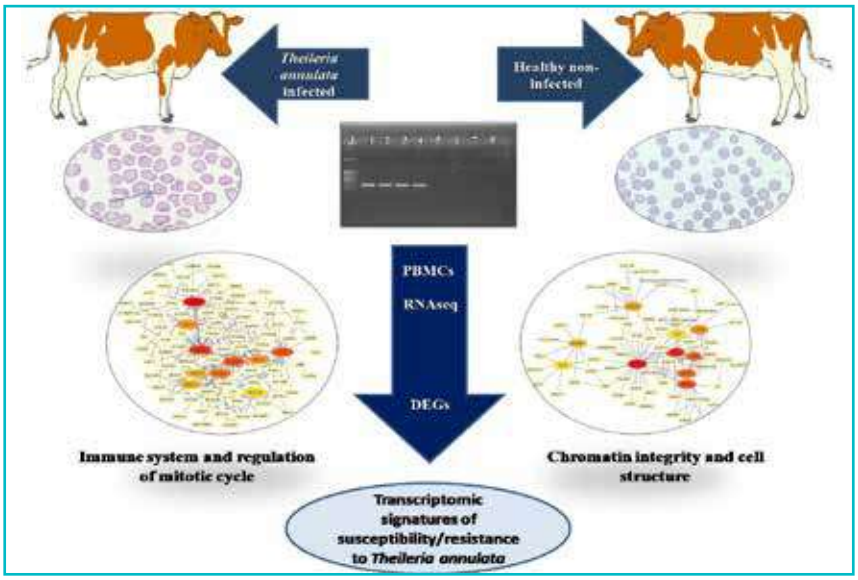


Fig 3: *Pathway enrichment analysis of MDE metabolites in Sahiwal and Holstein Friesian*

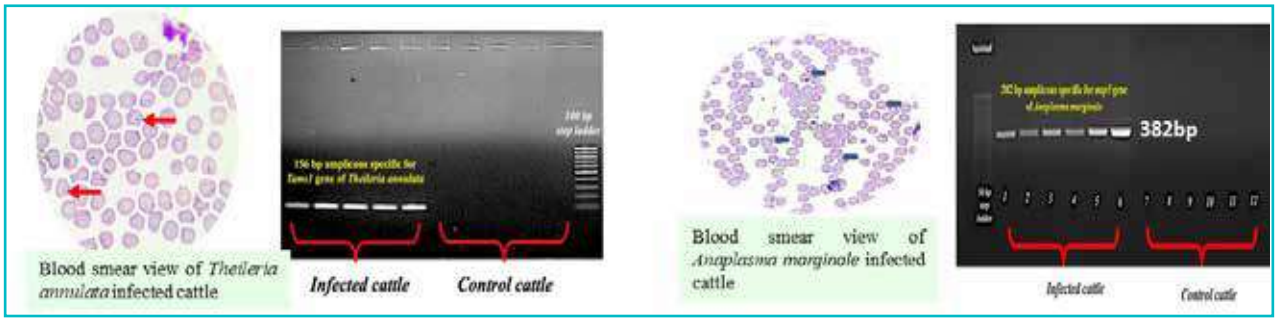
Identifying host response genes and pathways for Theileriosis in crossbred cattle:

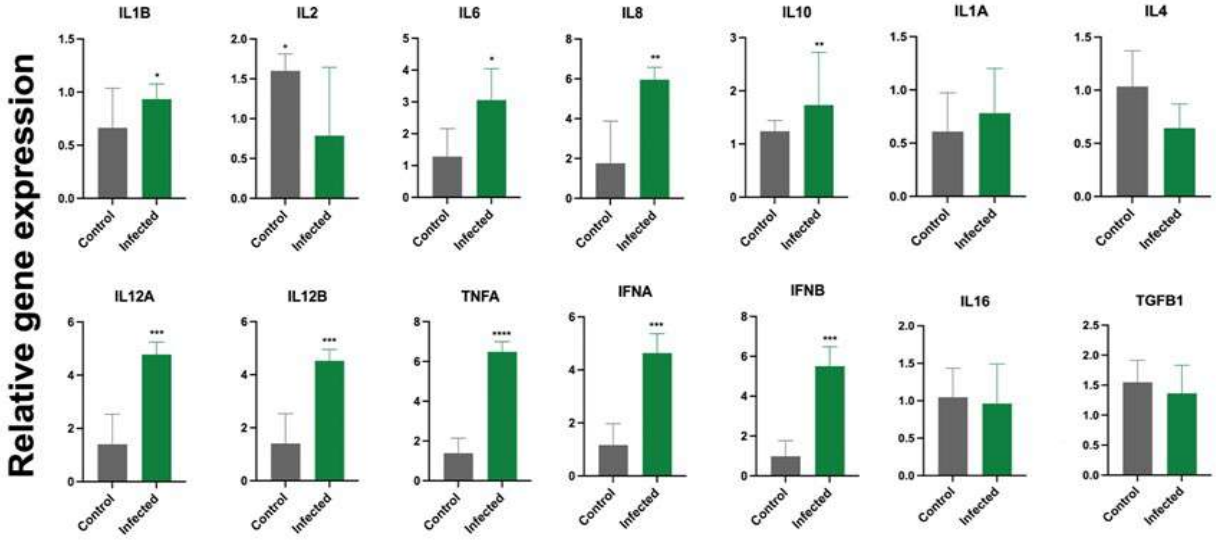
Theileriosis is a tick-borne haemoprotozoan disease that affects cross-bred cattle in Asia, Africa and Europe resulting in major economic losses. India is the largest milk producer in the world with the cattle population contributing to almost half the total produce (BAHS, 2019). Crossbred cattle population contributes significantly to milk production. Theileriosis affects 30-60% of cross-bred (*Bos indicus* x *Bos taurus*) cattle in India, resulting in substantial losses. However, the molecular mechanism underlying the host in response to the parasitic infection remains poorly understood. It is crucial to fathom the molecular drivers of resistance and susceptibility to *Theileria annulata*. Although, recent progress has been made to understand the gene expression changes in response to *Theileria* infection in buffalo, native and crossbred cattle *in vitro*. However, a comprehensive insight into the transcriptional dynamics of theileriosis occurring under field conditions is lacking. Therefore, the differential expression profiles between *Theileria annulata* infected and non-infected crossbred cows of the same age group and management conditions was investigated to gain insights into the transcriptional dynamics of resistance/susceptibility to *Theileria annulata*. RNA sequencing was performed on peripheral Blood mononuclear cells (PBMCs) from four biological replicates of infected and non-infected crossbred cows, generating more than 81 million reads on average across the samples. We observed a marked difference in the expression of genes associated with innate immunity (*FTH1, ACTB, ISG15)* was observed between two groups. The over-represented pathways in *Theileria annulata* infected cows were associated with immune system and regulation of mitotic cycle whereas, pathways enriched in non-infected animals were related to histone deacetylases (HDACs), telomerase maintenance as well as nucleosome assembly. These findings suggests importance of maintenance of chromatin integrity, which may play a protective role in the host cell. The top ten highly connected genes in infected animals, which were involved in interferon signaling and cell cycle regulation. In non-infected animals highly connected genes were associated with histones or cell structure. The transcriptomics signatures identified in this study serve as potential candidates for further investigation into parasite resistance in cattle. An improved understanding of the host response to theileriosis would lead to better management and control of the infection.



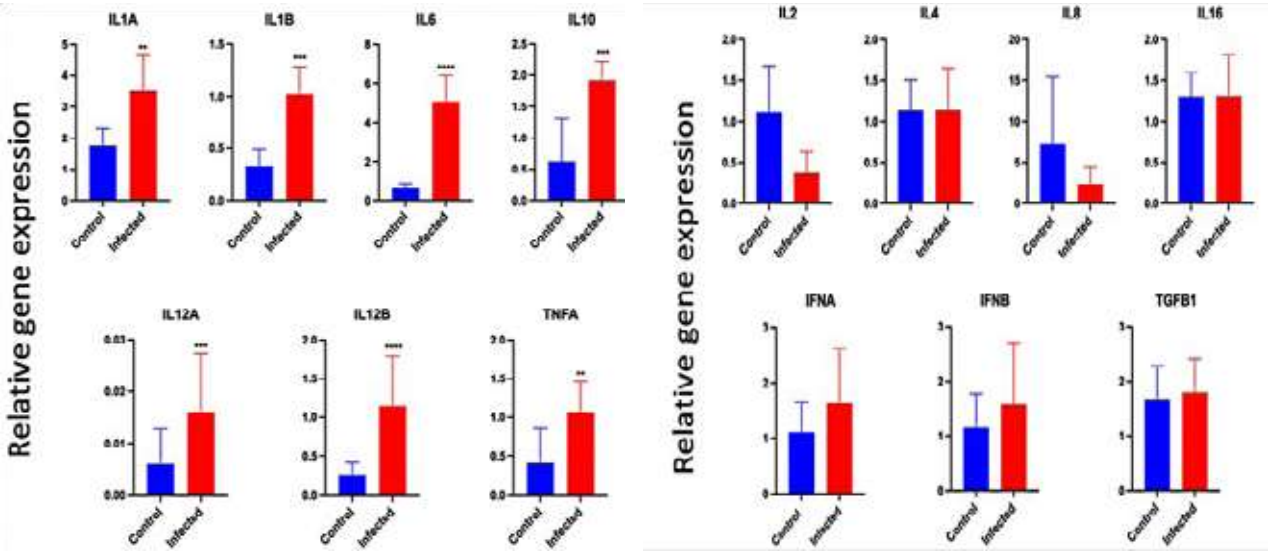
Differential cytokines expression for theileriosis and anaplasmosis in cattle

Cytokines are important mediators of signaling cascades that greatly influence the outcome of any infectious perturbation. They have an essential role in the initiation as well as the development of systemic inflammation in the host. They are also important for mediating and regulating almost all the aspects of the immune system to an infection. Despite being highly important to the host for defense, extreme levels of cytokine may cause deleterious effects, leading to unwanted tissue injury and organ dysfunction. Pro-inflammatory cytokines, such as *IL1A, IL1B, IL6, IL8, IL12* and *TNFA* which are crucial for initiating an effective inflammatory response. Therefore, expression profiles of genes encoding 14 cytokines (*IL1A, IL1B, IL2,IL4, IL6, IL8, IL10, IL12A, IL12B, IL16, IFNA, IFNB, TGFB1* and TNFA) were investigated in crossbred cattle infected with Theileria annulata and Anaplasma marginale, compared to healthy animals. Health status of the animals was determined based on clinical signs, blood smear examination and molecular detection using specific primers for Theileria and Anaplasma. Total RNA was isolated from the peripheral blood mononuclear cells of the infected animals as well as the healthy controls, and cDNA was synthesized for further anlaysis. Expression profiles were compared by real time quantitative PCR, using RPS15 and GAPDH as reference genes. For the Anaplasma dataset, the expression levels of *IL1A, IL1B, IL6, IL10, IL12A, IL12B* and *TNFA* were significantly higher in the infected cattle compared to the healthy control. However, there were no significant differences in the expression of *IL4, IL16* and *TGFB1* between diseased and healthy animals. The expression of *IL2* and IL8 was higher in the healthy animals, but the results were non-significant. The comparative expression profiling of theileria infected and healthy cattle revealed that *IL1B, IL6, IL8, IL10, IL12A, IL12B, TNFA, IFNA* and IFNB genes were expressed at a significantly higher level in healthy animals. Conversly, *IL1A* and *TGFB1* showed higher expression in the infected animals. This study provides the insight into the expression kinetics of various pro-inflammatory and anti-inflammatory cytokine genes in response to bovine anaplasmosis and theileriosis.





Relative gene expression of cytokine genes between Theileria annulata–infected and healthy cattle
*(** = p < 0.01, *** = p < 0.001,**** = p < 0.0001)*



(A) **(B)**

Relative gene expression of cytokine genes between healthy control cattle and Anaplasma infected cattle using 2_DDCt method;
***(A)** significant **(B)** Non-significant. The gene expression was normalized by geometric mean of RPS15 and GAPDH.*
*(** = p < 0.01, *** = p < 0.001, **** = p < 0.0001)*

Genes and pathways associated with melanogenesis and cellular adaptive mechanisms in Kadaknath chicken

Kadaknath, popularly known as *Kaala Maasi*, is a well-recognized black meat chicken breed of India. The black meat of Kadaknath is considered to be nutritious and better than commercial broilers or *desi* chicken owing to low cholesterol and high protein content. However, the characteristic attributes of Kadaknath meat have not been explored through contemporary genomic approaches. Therefore, expression profiles from breast muscles of four samples each of black meat (Kadaknath) and white meat (broiler) chicken breeds were generated by RNA sequencing, in an attempt to identify differentially expressed genes. All the samples showed an alignment of more than 97% to the reference genome. A total of 13206 transcripts were common in both groups, while 207 transcripts were unique to Kadaknath and 259 transcripts were unique to broiler chicken. The melanogenesis and tyrosine metabolism pathways were enriched in Kadaknath, while the calcium signaling pathway was enriched only in broiler chicken. The highly connected significant genes identified in Kadaknath (ATFs, C/EPDs) were observed to be important regulators of cellular adaptive functions, while in broiler the hub genes were involved in cell cycle progression and DNA replication. These research findings will aid in underpinning the molecular mechanism of melanogenesis and adaptive cellular regulation in the skeletal muscle of the black meat chicken breeds.

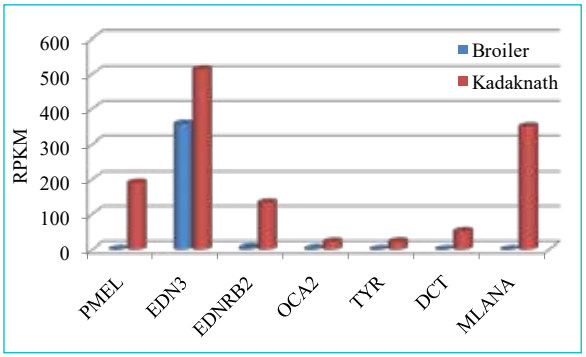
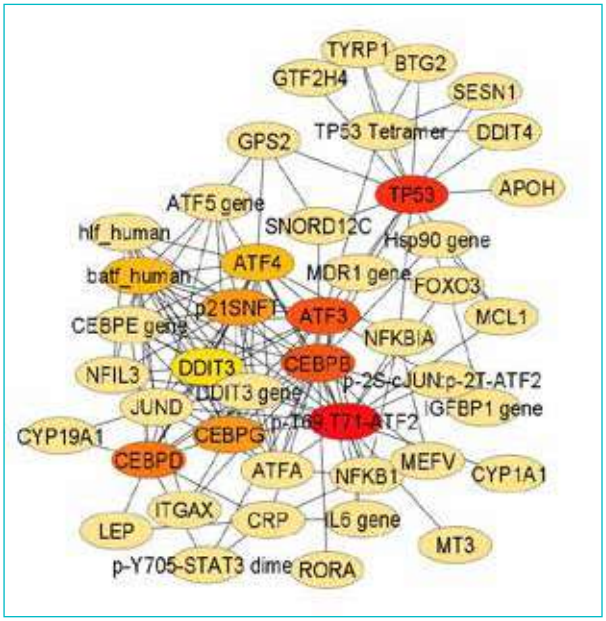
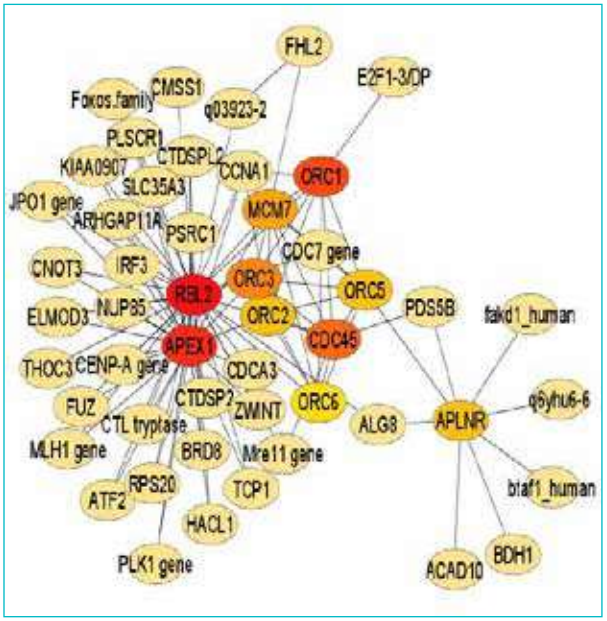


Figure . Genes associated with pigmentation showing different expression levels in Kadaknath and broiler chicken.



Highly connected (>5 degree) up-regulated genes in Kadaknath chicken. Colour intensity of top 10 genes changes from orange to red with increasing order of rank.



Highly connected (>5 degree) up-regulated genes in broiler chicken. Colour intensity of top 10 genes changes from orange to red with increasing order of rank.

Genomic selection footprints in Changthangi goat

To explore genetic variations and selection footprints, whole genome re-sequencing (~10X) of 10 Changthangi goat samples from Ladakh region of Jammu and Kashmir. The resequencing was performed on the Illumina NOVASEQ 6000 platform using 150 bp paired-end chemistry. Additionally, we downloaded ten Angora goat whole genome resequencing data to compare the genomic variants with Changthangi goat. Through analysis we identified a total of 22.5 million single nucleotide polymorphisms (SNP) and 3.5 million insertions and deletions (INDEL) in Changthangi goat genome. To explore selection footprints there approached were employed composite likelihood ratio (CLR), nucleotide diversity (θπ), and fixation index (FST). By utilizing the top 1% of selection signatures, we were able to identify 1276, 206, and 700 genes, respectively. Candidate genes under selection pressure included FGF5, FGF9, KRT17, KRT71, STK3, TCF7L1, FGF20, SOX10, CUX1, and IGFBP7, which are potentially assoiciated with hair or fibre characteristics as well as adaptive traits (NOS2, PRKCB). Significant enrichment of KEGG pathways like Ras signaling pathway, MAPK signaling pathway and Focal adhesion, which are associated with skin hair follicle developments and hair follicle morphogenesis, were identified. The enrichment of the HSF-1 signalling pathway among the top selection signatures also supports Changthangi goat's adaptation to the hypoxic environment at high altitudes.

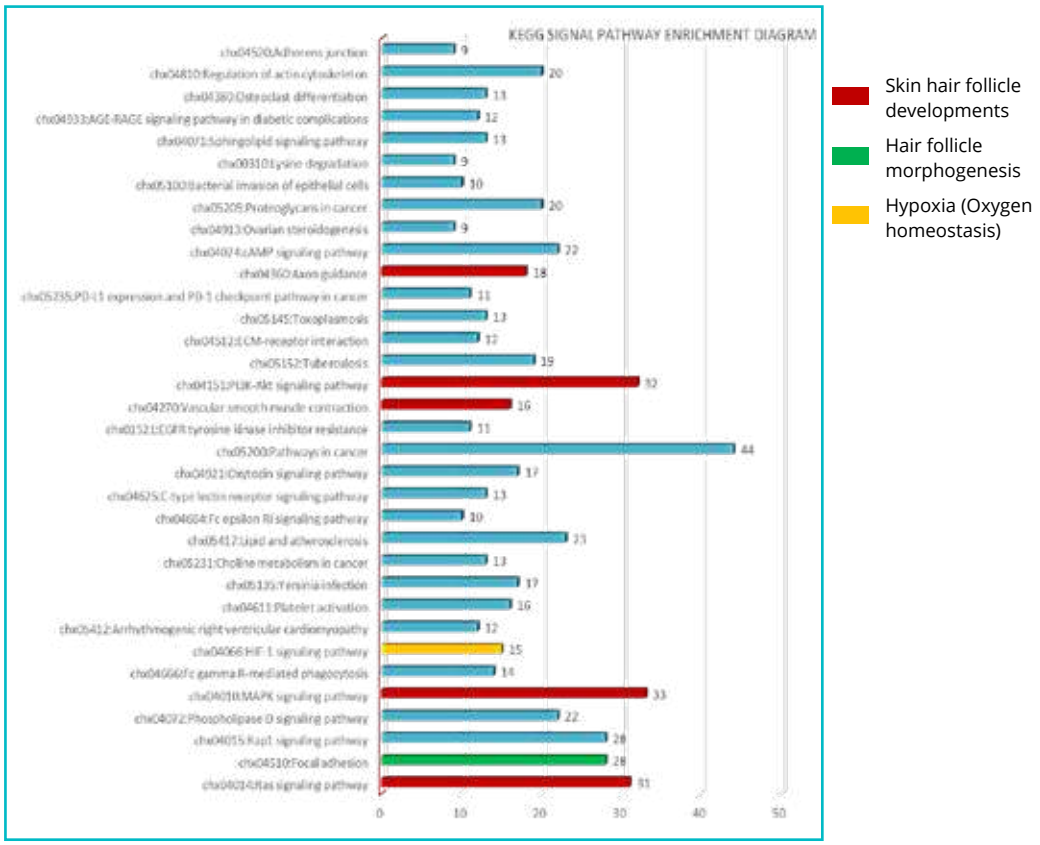


Fig.2 KEGG signal pathway enrichment diagram. Numbers to right of columns indicate number of genes enriched by each signaling pathway (P<0.05)

Epigenomic changes in buffalo sperm cells due to heat stress

This study focuses on investigating the epigenomic changes in buffalo sperm cells as a result of heat stress., Murrah buffalo bulls under semen production at ABRC of NDRI, Karnal, were classified into seasonally affected (SA) and seasonally non-affected(SNA) based on the semen quality parameters recorded during hot summer season. DNA was isolated from the purified sperm cells obtained through Bovipure density gradient and genome wide methylation data generated using RRBS technique. Analysis of epigenome data revealed hypermethylated CpG sites in the promoter region of the genes associated with pathways like oocyte meiosis, MAPK signalling and oxytocin pathways. These pathways are involved in important processes like sperm cell differentiation, spermiation, and sperm morphology in seasonally affected buffalo bulls experiencing heat stress.

Among the differentially methylated CpGs (DMCs), 58 genes were found to be associated with 'meiosis' pathway with an enrichment score of 1.3 and Benjamini adjusted P value 0.022. Of these genes, 8 genes showed methylation in the promoter region. Among the spermatogenesis associated genes, *TEX29, SEPT9-SEPT6-SEPT4, CCR7* and unidentified locus LOC102397479 exhibited significant hypomethylation and *NPTN, CEP170B, ANO1, RPL31* and *GRAMD4* showed major hypermethylation of CpGs sites in the promoter region among the animals affected by summer stress. *DAZL*, *SPATA17*, and *SPATA19* were found to be hypermethylated at the CpG sites in intergenic regions. Overall, the study helped in identifying provides insights into differential methylation pattern of genes associated with summer stress induced changes in semen quality. These finding can be further explored in the bulls with fertility records for association studies and may contribute to future investigations linking epigenomic changes with transcriptome data.

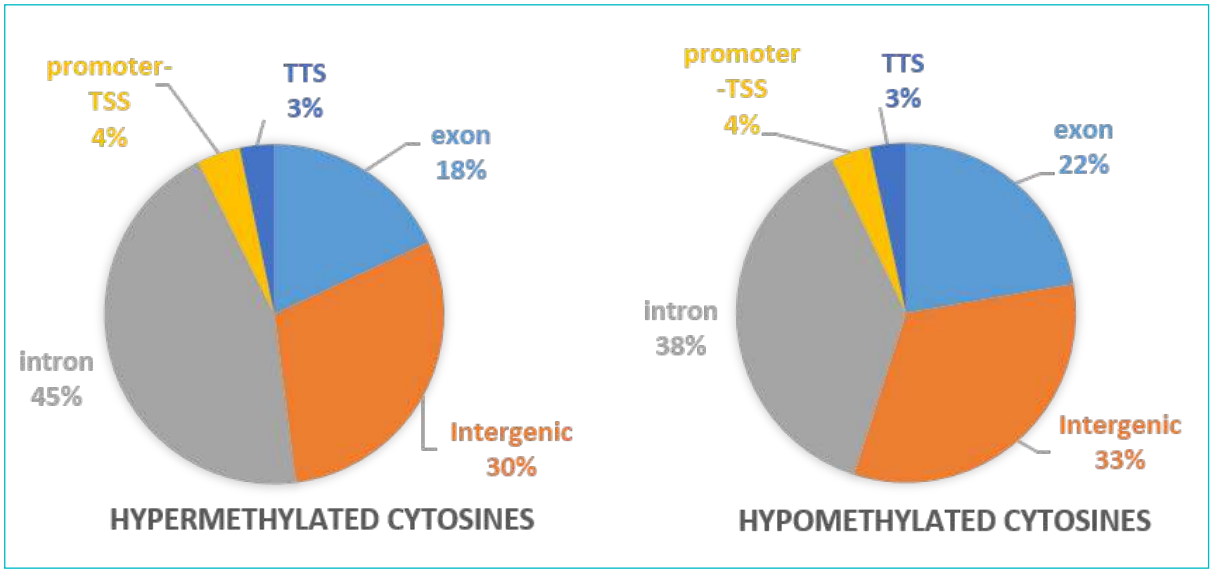


Fig. *Distribution of hypermethylated & hypomethylated cytosines in the genic regions (TSS-transcription start site, TTS-transcription termination site)*

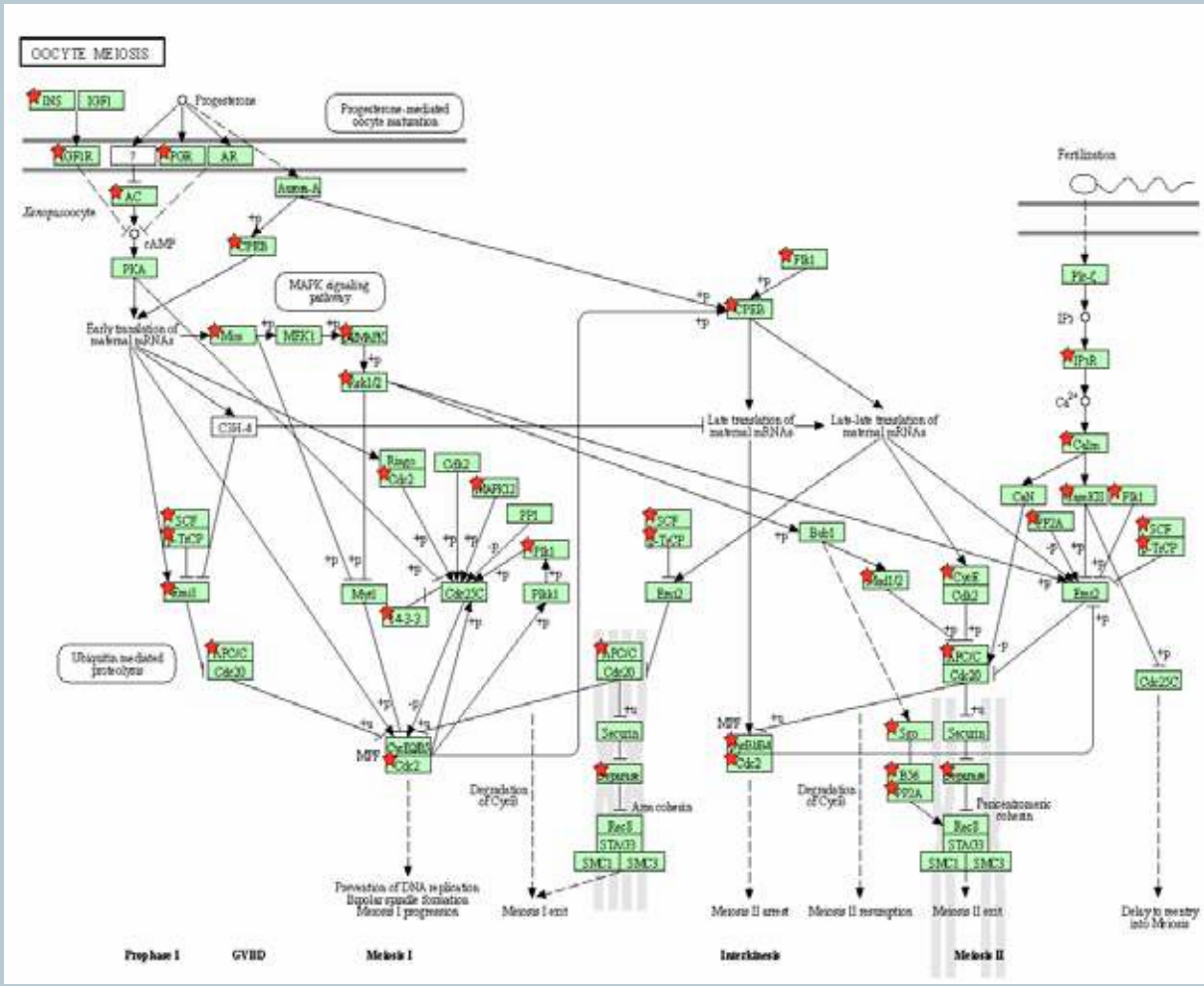


Fig. Meiosis pathway (KEGG ID: bta04114) illustration. The hypermethylated and hypomethylated genes from the current dataset occurring in the pathway have been marked with red asterisk.

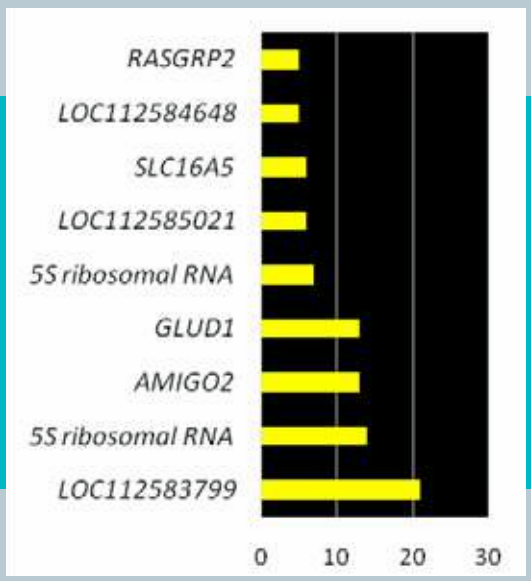


Fig. *Frequency of differentially methylated (Hypermethyalted) cytosines (diff.meth>+10) in the promoter region (n>5). This study aimed to assess the impact of mitochondrial copy number on semen quality in Murrah buffalo breeding bulls under seasonally affected (SA) and seasonally non-affected (SNA) conditions during heat stress. The semen quality data collected across different seasons (winter, hot humid, hot summer, and comfort seasons) were used to classify the bulls into SA and SNA groups based on the presence or absence of heat stress.*

Assessing effect of mitochondria copies on semen quality during stress

Buffalo breeding bulls with seasonally affected and non-affected semen quality were assessed for the impact of mitochondrial copy number on the semen quality during heat stress. Based on the semen quality data available across different seasons (winter, hot humid, hot summer and comfort seasons), Murrah buffalo breeding bulls were classified into seasonally affected (SA) and seasonally non-affected (SNA) by heat stress. The semen samples were collected from 8 target animals (4 animals each group) during winter and hot summer. Mitochondrial DNA copy number in frozen semen samples across groups and seasons (winter and hot summer) was estimated by real-time PCR using Ct values of a mitochondrial coded gene (*CYTC*) and normalized using the nuclear-coded gene (*BACT*). Mitochondrial DNA copy number was found to be highest in winter SA (13.68 ± 0.87) and lowest in winter SNA (10.93 ± 1.76). The mean of mitochondrial DNA copy number for all the animals was 13 ± 2 and ranging from 8 to 18. This is the first report of Mitochondrial DNA copy number in Murrah Buffalo bulls' sperm cells. Biochemical analysis of the frozen semen including, Mitochondrial Membrane Potential, Superoxide levels, Acrosomal integrity and oxidative stress levels of the seminal plasma, were also estimated. The results showed that mitochondrial membrane potential (MMP), intact live acrosome (LI), and catalase levels were positively correlated with semen quality of selected parameters in fresh as well as frozen semen of Murrah bulls. However no significant relationship was observed between mtDNA copy number in sperms and these parameters. The study indicates that there were no significant changes in mitochondrial copy numbers across seasons in sperm cells. However variations in other mitochondrial parameters were observed in both summer stress affected and non-affected bulls.

Figure. .....

Identification of ICGs for buffalo sperm cells gene expression analysis

In order to ensure accurate qRT-PCR-based expression profiling, it is crucial to establish robust RNA isolation technique for optimum RNA quality from both fresh and frozen buffalo bulls semen samples. Several factors, including RNA quality, primer design, enzyme efficiency, optimized annealing temperature, and accurate normalization of expression data using stable housekeeping gene(s) or ICGs (internal control genes) are crucial for qRT-PCR-based expression profiling. Internal control genes for frozen spermatozoa in Murrah buffalo identified across hot summer and winter season for selecting most stably expressed genes for normalizing transcriptional profiles. Using real time PCR data generated using set of primers representing different house-keeping genes were analysed using GeneNorm, NormFinder, and Bestkeeper tools to identify most stable ICGs. Based on our analysis, we identified Beta-2-microglobulin/eukaryotic translation elongation factor 2 and protein phosphatase-1-alpha/glyceraldehyde-3-phosphate dehydrogenase as suitable housekeeping genes for frozen and fresh semen samples with respect to summer and winter season, respectively. These genes exhibited stable expression levels and can be used as reliable references for normalizing gene expression in frozen buffalo spermatozoa. For sperm cells purified from semen samples collected during the sweltering summer season from the seasonally affected vs. seasonally not affected, none of the afore mentioned genes showed statistically significant fold change differences. This finding suggest that these genes identified would yield the most reliable results for transcriptomic studies of frozen buffalo spermatozoa.

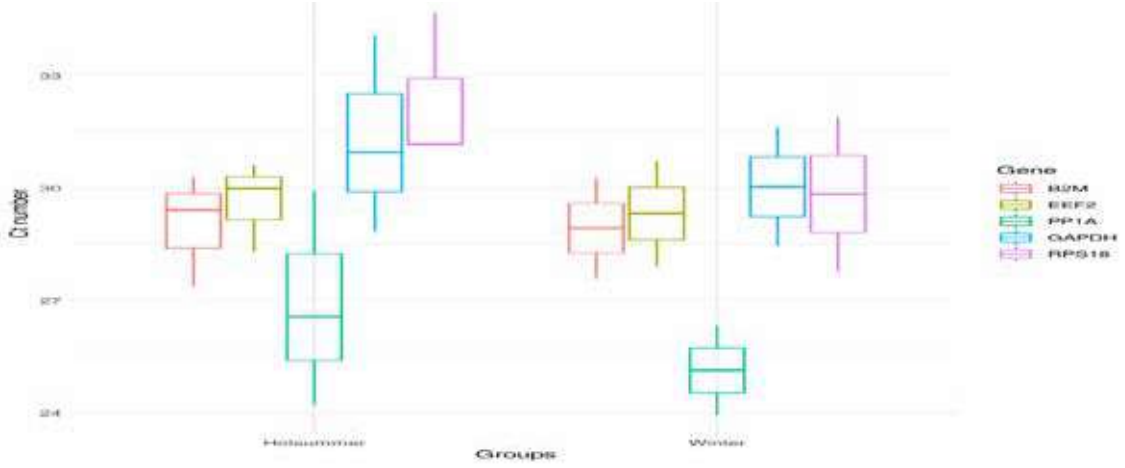


Fig. Distribution of Ct values across various ICG panel genes.

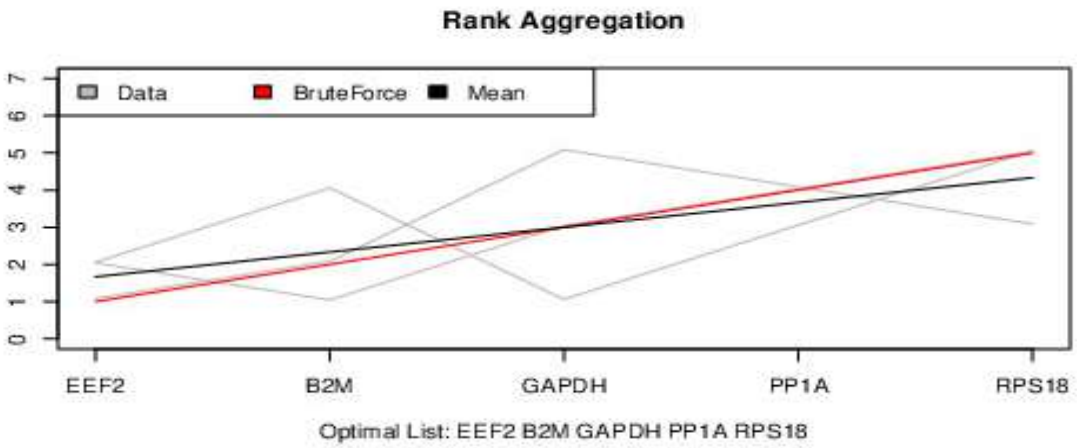


Fig. Ranking of ICGs based on stability of their expression across semen samples.

Optimizing Genomic Selection using Genetic Algorithm

Accuracy of genomic prediction in livestock is influenced by SNP markers as well as the size of reference population. To maximize the accuracy of genomic selection, genetic algorithms (GA), which are computational procedures that start with a random string of variables and use genetic operators to progress towards optimum solution of a function. In this study, GA was used to find subset of SNP markers that would enhance accuracy of genomic selection. A publicaly available dataset on Pig, consisting of 3534 animals, 52843 SNP markers and five traits with masked names - T1, T2, T3, T4, T5 with heritability equal to 0.07, 0.16, 0.38, 0.58, 0.62, respectively, was utilized. From this dataset, random subset on 10000 markers was filtered for analysis. GA employed RR-BLUP was used as objective function . Pearson correlation coefficient between observed phenotypic values and GEBV for a trait was used to obtain prediction accuracy. Sixty percent of animals were used in training set, 20% in validation set and 20% in test set. Five experiments were conducted using GA and RR-BLUP. GA selected about half of all markers to provide average prediction accuracies equal to 0.065 for T1 and 0.46 for T5, which were comparable to the RR-BLUP using all the markers. The prediction accuracies using RR-BLUP with 5000 randomly selected markers out of 10000 markers were lower at 0.060 for T1 and 0.45 for T5. Thus GA selected a subset of markers to provide better prediction accuracy compared to matching number of random markers. It was observed that accuracy in the validation set exhibited over fitting.

GA was also used for finding subset of reference population so as to maximize accuracy of genomic prediction using same pig dataset. GA selected half the number of animals in training-set, and showed lower values of average prediction accuracy compared to RR-BLUP for total number of animals. But GA provided higher prediction accuracy compared to those obtained using RR-BLUP for half the number of animals selected randomly from the training-set. For traits T1 and T5, GA provided prediction accuracy equal to 0.05 and 0.42 as compared to 0.06 and 0.46 given by RR-BLUP for total animals, and 0.03 and 0.40 for randomly selected half the number of animals. GA could find subset of animals for better genomic prediction as compared to matching random subset of reference population.

Identification of potential deleterious DNA mutations in Sahiwal cattle

In an insilico study aimed at exploring the deleterious mutations in Indian native cattle, ddRAD sequence data from 12 Sahiwal cattle were annotated using Ensemble. Initially a total of 91.10 million reads were obtained , which were then further aligned with the cattle (*Bos taurus*) reference genome ARS-UCD1.2. A total of 1,62,377 SNPs were annotated at RD10, including 430 SNPs identified as missense (nonsynonymous) using Variant Effect Predictor (VEP) tool. Among these, 45 missense variants were found deleterious based on their SIFT score. Furhter analysis using PolyPhen-2, PANTHER, PROVEAN, Predict SNP, MAPP, SNAP, and PhD-SNP tools revealed only four missense SNPs were predicted to be commonly deleterious. These four mutations were further mapped to the WDR4 (C40Y), ZNF280B (A242D), CCT6A (N234K) and CYP2C87 (D416Y) genes.

Based on the associated function and effect of mutations of that gene in humans, two mutations

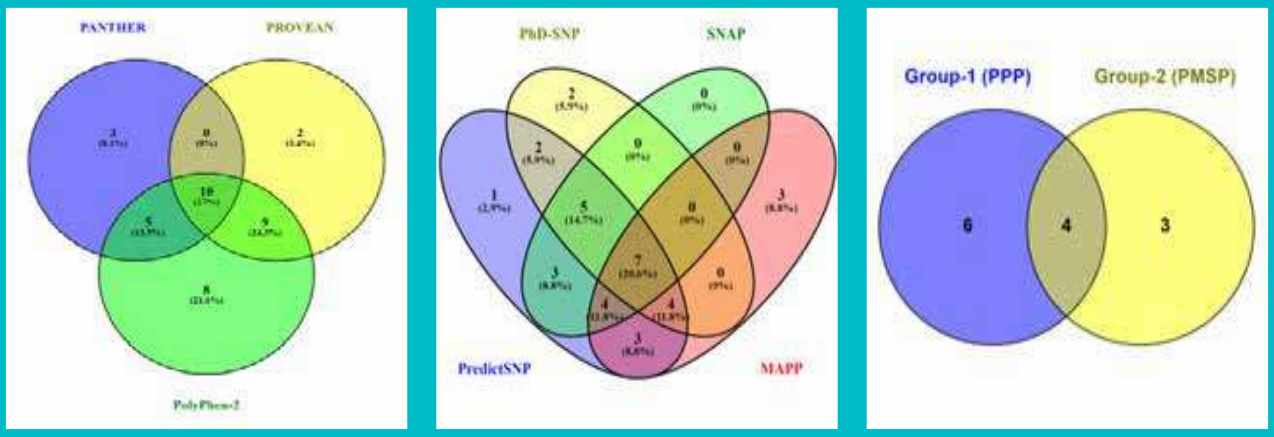


Figure: Ven diagram for deleterious mutations using bioinformatic tools. Four missense SNPs, were mapped on WDR4, ZNF280B, CCT6A and CYP2C87 genes were predicted as deleterious by various tools.

were selected for screening, C40Y in the WDR4 gene and A242D in the ZNF280B gene. PCR-RFLP and Allele-specific PCR assays were developed for screening of these two variants (C40Y &A242D). Subsequently, screening of 120 Sahiwal cattle was carried out using these assays. In the screening of A240D (ZNF280B), 104 animals were found to be homozygous for the wild allele, 14 heterozygous, and 2 were homozygous for the altered allele. In the screening of C40Y (WDR4), 113 animals were homozygous for the wild allele, 7 were heterozygous, and none were homozygous for the altered allele. The study predicts presenece of 4 deleterious SNPs in Sahiwal (Bos indicus)

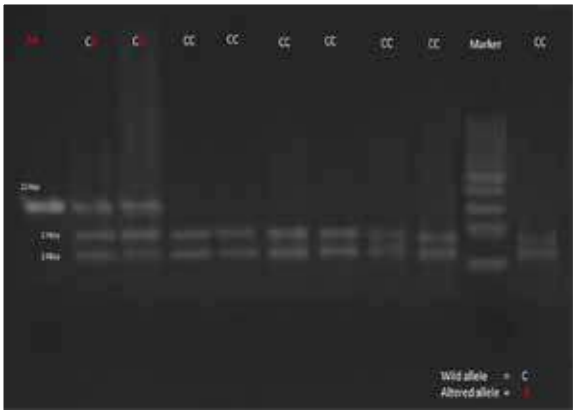


Figure: Genotyping of g.70983408C>A (A242D) locus at ZNF280B gene

cattle, which may be further warrant *in-vitro*/*in-vivo* studied to validate their possible deleterious effects.

Cytogenetic/DNA based screening of genetic diseases in breeding bulls

Cytogenetic screening was performed on a total of 205 cattle and buffalo individuals that were kept for breeding purpose by 11 government agencies of three states. Additionally a total of 5 cattle bulls were also screened for DNA testing for genetic diseases namely BLAD, Citrullinemia Factor XI deficiency and DUMPS (HF and HF crosses only). The result of cytogenic screening and genetic testing revealed that all the bulls had normal karyotypes and genotypes, to which those were screened for. The institute generated a revenue of total ₹ 219800/- from the testing of the samples. By conducting screening and genetic testing of animals, the institute plays a vital role in safeguarding the breeding programs and overall genetic health of these valuable animal resources.

Conservation of native AnGR

ICAR-NBAGR is conserving indigenous breeds of livestock through cryopreserving the germplasm in its National Gene Bank. During 2022 is an outstanding year for cryopreservation of farm animal germplasm. This year, the germplasm of 29 indigenous breeds (was cryopreserved at National Gene Bank. Presently, the germplasm of 59 indigenous livestock breeds in form of semen and 33 livestock breeds in form of somatic cells have been cryopreserved. The Bureau has cryopreserved the germplasm of the 19 indigenous breeds 'at risk' (50 percent of breeds at risk), in form of semen/ somatic cells/ova in its National Genebank. It contributes towards our national commitment for the United Nations 2030 Sustainable Development Goal 2.5.1 (*Number of (a) plant and (b) animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities*).

Semen cryopreservation

Total 30660 semen doses from 15 breeds were cryopreserved at National Gene Bank Germplasm. These breeds included -Red Kandhari, Nimari, Deoni, Gaolao, Bhinjharpuri, Ghumsari, Khariar cattle; Ganjam, Jamnapari, Beetal, Berari, Osmanabadi, Sirohi, Sangamneri and Barbari goat.

Somatic cell conservation:

The cryobanking of somatic cells has been successfully accomplished for the 14 breeds of domestic livestock including 1 breed of camel, 2 breeds of goat, 5 breeds of cattle, and 6 breeds of pig. These breeds are- Mewati, Purnea, Hariana, Ladakhi and Shweta Kapila cattle; Konkan Kanyal and Changthangi goat, Agonda Goan pig, Mewati camel, Ghoongroo, Doom, Purnea, Wak Chambil and Niang Megha pig. Four breeds at risk categories as per the recently released Breed Watch List 2022 by ICAR- NBAGR were prioritized for cryopreservation. Ear marginal tissue fibroblast cell lines were successfully established for male and female. The skin tissue explant culture method was utilized to obtain the somatic cells. Fibroblast cells that had typical fusiform morphology with centrally located oval nuclei and were showing flame-like or whirlpool-like migrating patterns were selected for cryofreezing. The cells were cryopreserved at 4th and 5th passage stocking at least 30 cryogenically-preserved vials (1×10^{6} cells/ml) per animal. Cell viability was above 95% before cryopreservation. Currently, the ICAR-NBAGR National gene bank has cryopreserved a total of 34 livestock breeds belonging to 9 different livestock species. These include 9 breeds of camel (including double hump camel), 7 breeds of pig, 6 breeds of cattle, 4 breeds of goat, 3 breeds of horse and donkey, and 1 breed each of yak and Mithun.

Oocytes preservation

Further 95 oocytes (vitrified) of 5 native breeds- Changthangi, Bhakarwal goat, Gurej, Changthangi and Karnah sheep were also cryopreserved.

Breed Watchlist 2022

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. 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.

Research Projects

Division & group wise research project

S.N.	Project type	Project	Workers	Duration	Status
ANIMAL GENETIC RESOURCES DIVISION					
1	*Institute funded (7.73)*	Optimisation of genomic selection in livestock species using genetic algorithm.	**Avnish Kumar**, Dinesh Kumar Yadav and SP Dixit	April, 2019 to March, 2022, Ext. up to Sept., 2022	*Ongoing*
2	*Institute funded (5.17)*	Characterization and documentation of indigenous dog breeds of india.	**Raja KN**, AK Mishra and RK Pundir	August, 2021 to March, 2024.	*Ongoing*
3	*Iinstitute funded (7.83)*	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*
4	*Institute funded (7.86)*	Computational judgement of livestock population uniformity on the basis of photographs.	**Avnish Kumar** and Dinesh Kumar Yadav	April, 2022 to March, 2024.	*New Initiative*
ANIMAL GENETIC DIVISION					
5	*Institute funded (Service project) (7.67)*	Karyotyping and dna testing for screening genetic defects in indian bovines.	**SK Niranjan** and Amod Kumar (from Aug 2021)	April, 2016 to March, 2021, ext. up to March, 2026	*Ongoing*
6	*Institute funded (7.75)*	Genomic diversity and selection signature of indian native goat breeds	**Indrajit Ganguly,** Sanjeev Singh, SP Dixit and Avnish Kumar	October, 2019 to Sept., 2022	*Ongoing*
7	*Institute funded (Service project) (7.78)*	Evaluation of genetic diversity in conserved cattle and buffalo bulls.	Amod Kumar	April, 2020 to Conti.	*Ongoing*
8	*Iinstitute funded (7.84)*	Genome analysis for adaptability to salinity in chilika buffalo.	**Amod Kumar**, SK Niranjan, Sanjeev Singh and Indrajit Ganguly	August, 2021 to July, 2023	*Ongoing*

S.N.	Project type	Project	Workers	Duration	Status
9	*Iinstitute funded (7.85)*	Admixture mapping of cattle in eastern and western india	**SP Dixit**, Indrajit Ganguly, Sanjeev Singh, Avnish Kumar Bhatia, SK Niranjan, Rahul Behl, Amod Kumar and MS Tantia	August, 2021 to March, 2026	*Ongoing*
10	*Ext funded (9.29)*	CRP on agro-biodiversity conservation of animal genetic resources.	**MS Tantia**, RAK Aggarwal and Rekha Sharma	June, 2015 to March, 2017, ext. up to March, 2020, ext. up to Sept., 2025	*Ongoing*
ANIMAL BIOTECHNOLOGY DIVISION					
11	*Institute funded (7.72)*	Phylogenomics of indian sheep breeds.	**Reena Arora** and Sonika Ahlawat	October, 2019 to September, 2022	*Completed*
12	*Institute funded (7.82)*	Transcriptome profiling of exosomes purified from milk/ colostrum of native and exotic cows.	**Monika Sodhi,** RS Kataria (NBAGR) and AK Mohanty & Sudarshan Kumar (NDRI)	July, 2020 to March, 2021, ext., up to Mar, 2022, ext. up to Sept., 2022	*Ongoing*
13	*Institute funded (7.87)*	Exploring the mitochondrial dna diversity of indian pigs and horses	**Sonika Ahlawat**, Reena Arora, Rekha Sharma and KV Singh	April, 2022 to March, 2024	*New Initiative*
14	*Ext Funded (9.30)*	CRP on genomics: - identification of markers for economic traits and transcriptomics study in buffalo and goats.	**Reena Arora** (PI from Apr. 2019) and Sonika Ahlawat	June, 2015 to March, 2017, ext. up to March, 2020, ext. up to Sept., 2025	*Ongoing*
15	*Ext Funded – CABin (9.31)*	Comparative genome analysis of indian chicken breeds.	**Reena Arora**(PI from Nov. 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*
16	*Ext Funded-DBT (9.32)*	Exploring molecular basis of seasonal variation of seminal attributes and identification of potential biomarkers for selection of buffalo bulls with quality semen.	**Pawan Singh** -PI-ICAR-NDRI, Pardeep Kumar-PI-ICAR-CIRB and **RS Kataria**-PI ICAR-NBAGR and Manishi Mukesh, RAK Aggarwal and MS Dige, Dharmender Kumar (ICAR-CIRB) and AK Tyagi (ICAR-NDRI).	14th September, 2020 to 13th September, 2023.	*Ongoing*

S.N.	Project type	Project	Workers	Duration	Status
17	*Ext Funded DST (9.33)*	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) and A Mohanty (NDRI), Manish Sharma (DRDO), Mh Zahid Ashraf (Jamia Millia), Sathees Rd IISc Banglore and Vijay Bharti (DRDO).	January, 2021 to December, 2023.	*Ongoing*
18	*Ext Funded (9.34) (IAEA Research Contract No. 24756)*	Delineating genomic diversity, population structure and demographic dynamics in diverse native buffalo breeds of india.' Coordinated research project (crp): "improving efficiency of animal breeding programs using nuclear related genomic information – practical applications in developing countries."	**Monika Sodhi**, RS Kataria, Manishi Mukesh and BP Mishra	Nov 2022-Oct 2027 (Five Years)	*New Initiative*
NEH Group					
19	*Institute funded NEH-1*	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- Mar, 2022, ext. up to March, 2023	*Ongoing*
20	*Institute funded-NEH-2*	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- Mar, 2022, ext. up to March, 2023	*Ongoing*
21	*Institute funded NEH-3*	Survey and documentation of native animal genetic resources of NEH region-Arunachal Pradesh.	**SK Niranjan,** AK Mishra, Amod Kumar and Jaideep Kumar Singh, KVK, Upper Siang, Geku (AP).	Oct, 2019- Mar, 2022, ext. up to March, 2023	*Ongoing*
22	*Institute funded NEH-4*	Survey and documentation of native animal genetic resources of NEH region-Sikkim	**RAK Aggarwal,** RS Gandhi, KD Bhutia (SLDB upto Apr. 2022), Jai Kumar S (upto Sept. 2020) and Aneet Kaur, ICAR-NRC Yak.	Oct, 2019- Mar, 2022 ext. up to September, 2022	*Ongoing*
23	*Institute funded NEH-5*	Survey and documentation of native animal genetic resources of NEH region -Tripura state.	**Raja KN,** Sanjeev Singh, PK Singh (upto Aug. 2021) and Rajesh Paul	October, 2019 to March, 2022	*Completed*

S.N.	Project type	Project	Workers	Duration	Status
24	*Institute funded NEH-6*	Survey and documentation of native animal genetic resources of NEH region-Nagaland	**DK Yadav**, Anand Jain (upto Oct. 2020), NK Verma (upto Aug. 2020) MS Dige, Hiabe Zeliang and Mahak Singh (ICAR-RC for NEHR, Nagaland)	Oct, 2019- Mar, 2022, ext. up to March, 2023	*Ongoing*
25	*Institute funded NEH-7*	Survey and documentation of native animal genetic resources of region-Manipur.	**Sonika Ahlawat,** Reena Arora, Rahul Behl and Th. Ranadhir Singh and PK Vij (upto Oct. 2020)	Oct, 2019- Mar, 2022, ext. up to March, 2023	*Ongoing*
26	*Institute funded NEH-8*	Survey and documentation of native animal genetic resources of NEH region - Assam.	**KV Singh,** MS Tantia, Rekha Sharma and Soumya Dash (upto Jan. 2021)	October, 2019 to March, 2022	*Completed*
FUNCTIONAL GROUP					
FUNCTIONAL GROUP I					
27	*Iinstitute funded (UP/2021)*	Identification and characterization of indigenous AnGR of Uttar Pradesh.	**AK Mishra**, RS Gandhi (upto Apr. 2022), Reena Arora, HK Narula (from July, 2022), Avnish Kumar, Amod Kumar, PS Dangi and Avneesh Kumar (DUVASU Mathura)	August, 2021 to March, 2023	*Ongoing*
FUNCTIONAL GROUP II					
28	*Iinstitute funded (TN and KA/2021)*	Survey and documentation of indigenous AnGR of Tamil Nadu & Kerala	**Raja KN**, RK Pundir and Sonika Ahlawat	August, 2021 to March, 2023	*Ongoing*
FUNCTIONAL GROUP III					
29	*Iinstitute funded (BR/ JH/2021)*	Characterization of AnGR of Bihar and Jharkhand states	**MS Tantia,** RAK Aggarwal, Rekha Sharma, PC Chandran, A Dey, Reena Kamal (ICAR for ER-Patana), RK Singh and B Kumar, (BAU, Patana) and Sushil Prasad (BU, Ranchi)	August, 2021 to July, 2023	*Ongoing*
FUNCTIONAL GROUP IV					
30	*Iinstitute funded (HP/2021)*	Identification of indigenous animal genetic resources of maharashtra, Gujarat, Goa and Himachal Pradesh	**Sanjeev Singh**, Indrajit Ganguly, SP Dixit and SV Kuralkar (PGIVAS- Akola)	August, 2021 to July, 2025	*Ongoing*

S.N.	Project type	Project	Workers	Duration	Status
FUNCTIONAL GROUP V					
31	*Iinstitute funded (MP/2021)*	Survey and documentation of native AnGR of Madhya Pradesh state	**SK Niranjan,** DK Yadav, Monika Sodhi, RS Kataria and Ajay Ramtake (DAH, MP)	August, 2021 to March, 2023	*Ongoing*
32	*Iinstitute funded (RAJ/2021)*	Identification, characterization, documentation and registration of non-descript animal and poultry genetic resources of Rajasthan.	**DK Yadav**, RS Kataria, SK Niranjan, Monika Sodhi and Sandeep Saraswat (AHD Rajasthan)	August, 2021 to March, 2026	*Ongoing*
33	*Iinstitute funded (CG/2021)*	Characterization and documentation of farm animal genetic resources of Chhattisgarh state.	**Monika Sodhi**, RS Kataria, SK Niranjan, and DK Yadav (NBAGR), Kishore Mukharjee (College of Vety Sci & AH Anjora, CGKV, Durg), Rohini Pathak (VS of Directorate of Vety Services, Chhattisgarh)	August, 2021 to March, 2026	*Ongoing*
FUNCTIONAL GROUP VI					
34	*Iinstitute funded (OD/2021)*	Cataloguing and characterisation of native non-descript animal genetic resources of Odisha.	**Dige MS**, M Mukesh, KV Singh, R Behl (NBAGR) and SK Dash, S Mishra, C Mishra (OUAT) MK Padhi (DPR, Bhubaneshwar)	August, 2021 to March, 2024	*Ongoing*
35	*Iinstitute funded LA(UT)/2021)*	Cataloguing and characterisation 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 from Dec., 2022)	August, 2021 to July, 2023	*Ongoing*
INTER-INSTITUTIONAL PROJECT					
36		Deciphering the genomic architecture of complex economic traits in Arunchali yak.	Aneet Kour, Martina Pukhrambam, Joken Bam (ICAR-NRC Yak) and **Amod Kumar**	September, 2021 to Aug., 2023	*Ongoing*

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- Pundir RK and Niranjan SK (2022). Registration of Animal Genetic Resources (AnGR) to protect the legal rights of stakeholders. In: Advances in Management of Animal Genetic Resources. [E-book]. National Institute of Agricultural Extension Management (MANAGE), & ICAR-National Bureau of Animal Genetic Resources, Karnal (Haryana), 132001, 1-187 pages ISBN: 978-93-91668-50-1 pp, 182-187. Online Training Programme on "Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity" conducted from 14-18 November, 2022 at ICAR-NBAGR.
- Raja KN (2022). Methodology for phenotypic characterization of livestock and poultry genetic resources through field survey. Raja K N, Sonika Ahlawat, Sagar Surendra Deshmukh, Mahesh Sadanand Dige and B P Mishra (2022). Advances in Management of Animal Genetic Resources [E-book]. Hyderabad: National Institute of Agricultural Extension Management (MANAGE), & ICAR-National Bureau of Animal Genetic Resources, Karnal (Haryana), 132001. pp 132-143. ISBN: 978-93-91668-50-1.
- Raja KN, Mishra AK, Purohit PBBB and Nandhini PB (2022). Registered Livestock and Poultry Breeds of India. Raja K N, Sonika Ahlawat, Sagar Surendra Deshmukh, Mahesh Sadanand Dige and B P Mishra (2022). Advances in Management of Animal Genetic Resources [E-book]. Hyderabad: National Institute of Agricultural Extension Management (MANAGE), & ICAR-National Bureau of Animal Genetic Resources, Karnal (Haryana), 132001. pp 143-181. ISBN: 978-93-91668-50-1.
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- Singh Karan Veer (2022). Biodiversity and Conservation Status of Indigenous Livestock of India. Biodiversity Threats and Conservation Edited By R C Sobti, CRC Press https://doi.org/10.1201/9781003220398.
- Tantia MS, Sharma R and Aggarwal RAK (2022). Need for conservation of indigenous AnGR: Strategies and success stories. In the book Advances in Management of Animal Genetic Resources (E Book) Editors: Raja KN, Sonika Ahlawat, Sagar Surendra Deshmukh, Mahesh Shivanand Dige and BP Mishra. Edition: 2022. ISBN: 978-93-91668-50-1: pp: 54-59.
- Yadav DK (2022). Indigenous AnGR in India: An approach to setting conservation priorities. In: Advances in Management of Animal Genetic Resources [E-book] edited by Raja K N, Sonika

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Ahlawat, Sagar Surendra Deshmukh, Mahesh Sadanand Dige and B P Mishra (2022). Hyderabad: National Institute of Agricultural Extension Management (MANAGE), & ICAR-National Bureau of Animal Genetic Resources, Karnal (Haryana), 132001, pp 19-21.

Popular article

अनुका यादव और संजीव सिंह (2022). कृत्रिम बुद्धिमत्ता और मशीन लर्निंग के साथ-पशु संचालन और प्रबंधन- एक नई आस के साथ विज्ञान की वैज्ञानिक शाखा। पशुधन प्रकाश, 13:22-27.

ए के मिश्रा, राजा केएन, वीनू, आर, राव जीएन और सागर जीएन (2022). दक्षिण भारत की मत्वपूर्ण मांस उत्पादक भेंड नागावली का प्रारूपिक अध्ययन। पशुधन प्रकाश, 13:13-15.

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Ahlawat S and Sharma R. (2022). Status, Issues, and Challenges of Indian Livestock Biodiversity. In: Kaur, S., Batish, D., Singh, H., Kohli, R. (eds) Biodiversity in India: Status, Issues and Challenges. Springer, Singapore. pp: 191-215, Print ISBN978-981-16-9776-0.

Mishra AK, Ahlawat S, Sharma RC and Singh MK (2022). Small Ruminant Genetic Resources of India and strategies for their genetic improvement, In: Technological interventions in improvisation of sheep and goat production / editors, Safeer Alam, Mohammad Tufail Banday, Mohammad Moin Ansari, For Write & Print Publications, New Delhi-110 052; pp: 91-130.

Monika Sodhi, Nampher Masharing, Vishal Sharma, RC Sobti, and Manishi Mukesh (2022). Role of omics technologies in animal sciences; published in book entitled “Genomic, Proteomics, and Biotechnology (ISBN 9781032116334) by CRC Press.

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SK Niranjan and M Mukesh (2022) Prospects of Genomics Tools in Conservation of Farm Animal Breeds. In: Genomic, Proteomics, and Biotechnology, CRC Press, Taylor & Francis. 191-197. https://doi.org/10.1201/9781003220831.

Sivalingam J, Vineeth MR, Kumar A, Elango K and Ganguly I (2022). Genomic Selection for Fertility in Bovines. In Frontier Technologies in Bovine Reproduction (pp. 309-328). *Springer, Singapore.*

Sudarshan Kumar, AK Mohanty, JK Kauhsik, Manishi Mukesh and Nikunj Tyagi (2022). Proteomics based advancement in research towards sustainable production from dairy livestock; published in book entitled "Genomic, Proteomics, and Biotechnology (ISBN 9781032116334) by CRC Press.

Book/compendium/monograph

RC Sobti, Manishi Mukesh and Aastha Sobti. 2022. Genomic, Proteomics, and Biotechnology (ISBN 9781032116334) CRC Press.

Raja KN, Ahlawat S, Deshmukh SS, Dige MS and Mishra BP (2022). Advances in Management of Animal Genetic Resources [E-book]. Hyderabad: National Institute of Agricultural Extension Management (MANAGE), & ICAR-National Bureau of Animal Genetic Resources, Karnal (Haryana), 132001. ISBN: 978-93-91668-50-1.

Manishi Mukesh, RS Kataria, Saket K Niranjan, *et al.* (2022) Zanskari Horse-A native pony of Ladakh with superior endurance. ICAR-National Bureau of Animal Genetic Resources, Karnal -132001 (Haryana) INDIA, Pp 56. ISBN 978-93-83537-49-5.

Niranjan SK, Vohra V, Kumar A and Alex R (2022) Compendium on Contemporary Technology for Animal Genetic Resource (AnGR) Management. In: National Symposium held at ICAR-NBAGR during September 21-22, 2022. Pg 188.

Awards & recognition

- Best paper Award- to research paper entitled Factor analysis to explain body conformation of Kajali rams, authored by Mishra AK, Raja KN, Vohra V, S Singh, Y Singh and Pundir RK. 2021, published in The Indian Journal of Small Ruminants, 27(1):19-23 during ISSGPU symposium held at CSWRI Avikanagar from 10.11.22 to 12.11.22.
- Best article award- first prize to the article published in पशुधन प्रकाश: सोनिका अहलावत, अनिशा कुमारी, रेखा शर्मा, रीना अरोरा, अन्नू शर्मा, सई सत्यनारायण (2021) पशुधन से प्राप्त दूध: रोगाणुरोधी पेप्टाइड का एक उत्तम स्रोत I पशुधन प्रकाश 12:46-53.
- Second Prize in Technical Session 1 to Oral presentation entitled Functional quality characteristics of the meat from an improved free-range chicken variety by Renuka Sehrawat, Rekha Sharma, Sonika Ahlawat, Vivek Sharma, MS Thakur, AK Mishra and MS Tantia during XIX Annual Convention & National Symposium on Contemporary Technology for Animal Genetic Resource (AnGR) Management 21-22nd September, 2022 at ICAR-NBAGR, Karnal.
- Best Poster award- First Prize to Sonika Ahlawat, Arora R, Mir MA, Singh MK, Sharma R, Chabra P, Kumar A and Kaur M. to Comparative transcriptome profiling of heart tissue provides insight into high altitude adaptation in Changthangi goat in Prospects and Potential of Small Ruminants Production for Enhancing Income under Changing Scenario organized at ICAR-Central Sheep and Wool Research Institute, Avikanagar, Rajasthan on 10-12 November, 2022.
- Best Poster award- First Prize to Kaur Rashmeet, Ahlawat S, Kaur M, Arora R, Sharma R and 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

Awards

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- II 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.
- Best poster awards to- Ankita Gurao, Ravinder Singh, S. Lava Kumar, V. Vohra, S.K. Niranjan, Monika Sodhi and R.S. Kataria. Genetic cryptic demographic mode shift analysis in Odisha and Chhattisgarhi buffaloes of India indicates absence of recent bottleneck. Poster-presented for young scientist award during during XIX Annual Convention (SOCDAB) and National Symposium on Contemporary Technology for Animal Genetic Resource (AnGR) Management (21-22nd September, 2022), at ICAR-NBAGR, Karnal.
- R.S. Kataria (2022). First prize Hindi Pakhwada award- Anuvaadpratiyogita 2022.
- Best oral presentation award- for the paper- Harsimran Kaur, Meenakshi Chitkara, Rashi Vasisth, Ankita Gurao, Manishi Mukesh, Mahesh Shivanand Dige, Karpenahalli Ranganatha Sriranga, Pawan Singh and Ranjit Singh Kataria. Molecular characterization of the promoter region and in-silico TF binding sites prediction in the sperm cells chromatin remodeling genes of Murrah Bulls. Abstract presented during XVI Annual Conference of Indian Society of Animal Genetics & Breeding (ISAGB) held at ICAR-DPR, Hyderabad during 2nd & 3rd December, 2022.
- Best oral presentation award for Genetic evaluation in production traits of Marwari sheep in organized flock of arid region by H.K. Narula, Ashish Chopra, Nirmala Saini, Ashok Kumar and Chandan Prakash. In National Seminar cum Annual Conference of Indian Society for Sheep & Goat Production and Utilization (ISSGPU) on Prospects and Potential of Small Ruminants Production for Enhancing Income under Changing Scenarios at ICAR- Central Sheep and Wool Research Institute, Avikanagar-304501, November 10-12, 2022.
- Best poster presentation award for "Evaluation of reproductive performance of Magra sheep in arid region of Rajasthan" by Ashish Chopra, HK Narula, Manju Bissu, N Saini, C Prakash and Ashok Kumar. In National Seminar cum Annual Conference of Indian Society for Sheep & Goat Production and Utilization (ISSGPU) on Prospects and Potential of Small Ruminants Production for Enhancing Income under Changing Scenarios" at ICAR- Central Sheep and Wool Research Institute, Avikanagar-304501, November 10-12, 2022. Pg 40.
- Best PG thesis award was presented to Shivam Bhardwaj (Major Advisor, Dr. Sanjeev Singh) for his PG thesis "Genome-wide association studies on Indigenous cattle for cold adaptation" during international conference on "Advances in Agriculture, Veterinary and Allied Sciences for improving livelihood and Environmental Security" on 28-30, Sep. 2022 at Srinagar jointly organized by ICAR-IGFRI, RRS (Srinagar) ICAR-

Institute Awards

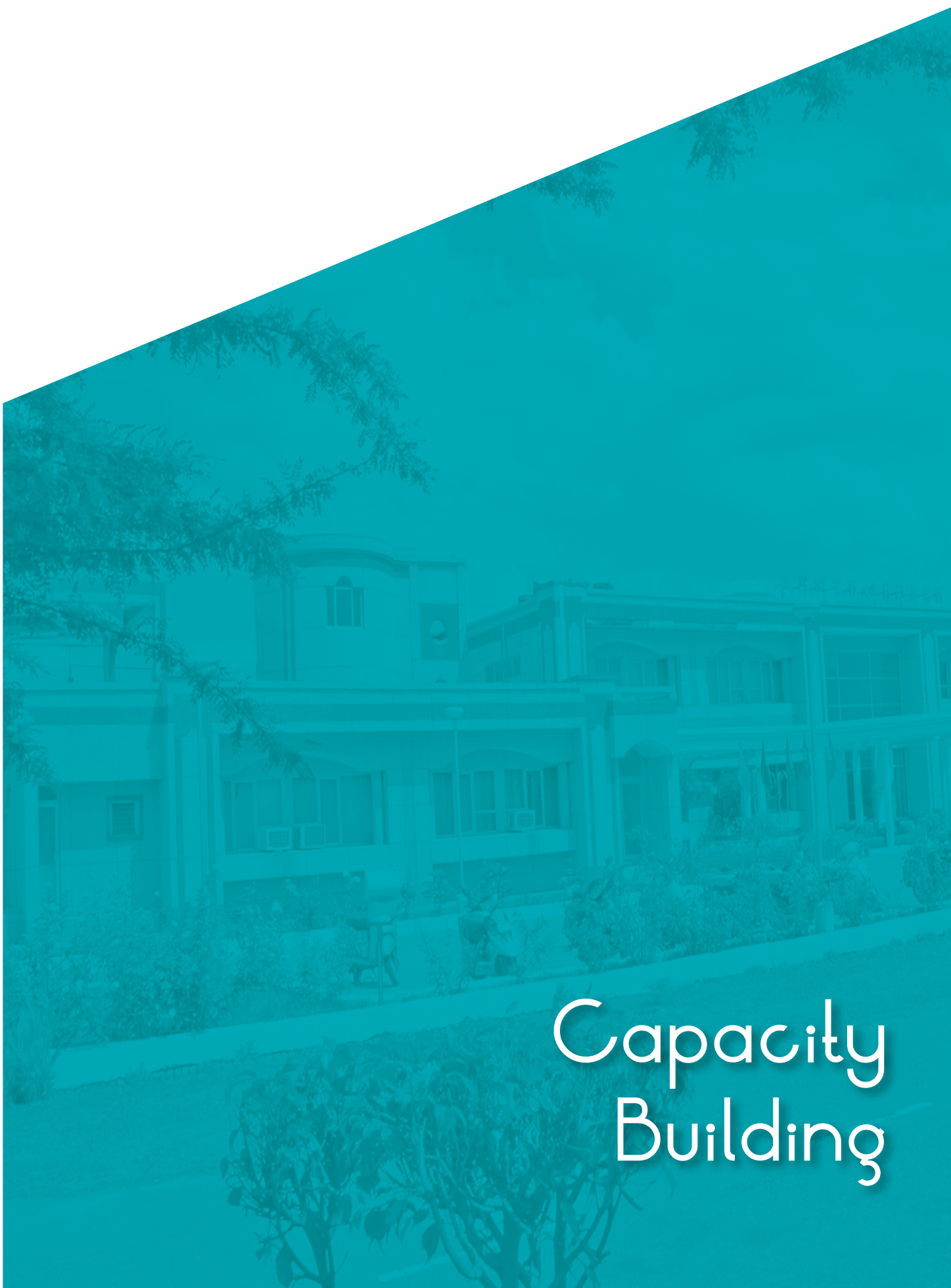
During the foundation day celebrations, deserving staff members were honored for their outstanding work throughout the year. Dr. Raja K N received the prestigious PG Nair Award for outstanding scientific contribution in 2022. Additionally, Mrs. Anita Chanda, Mrs. Parvesh Kumari, and Mr. Krishan Lal were recognized and awarded for their exceptional contributions.

NAHEB BAU, Ranchi, Jharkhand and NADCL, Baramulla, J&K.

- Best oral presentation award to Arora R, Ahlawat S, Chhabra P, Sharma U, Kaur M and Kumar A. Whole mitogenome based genetic diversity analysis of Indian sheep. In National Seminar and Annual Conference on "Prospects and Potential of Small Ruminants Production for Enhancing Income under Changing Scenarios" organized at ICAR-Central Sheep and Wool Research Institute, Avikanagar, Rajasthan on 10-12 November, 2022.
- Second best poster award: Raja KN, Dige M, Singh KV, Mukesh M, Sheikh F, Pundir RK, Mishra AK and Mishra BP. 2022. Changkhi Dog Breed: An integral part of Changpa nomads and an unexplored unique canine genetic resource of Ladakh, National Symposium on Contemporary Technology for Animal Genetic Resource Management , held at ICAR- NBAGR Karnal from 21.9.2022 to 22.9.2022.

Fellow /Associate of the Academy

- Dr. B P Mishra, Dr. Rekha Sharma and Dr. Indrajit Ganguly were awarded Fellow of the Society for Conservation of Domestic Animal Biodiversity (SOCDAB) on 21st September, 2022 during XIX Annual Convention & National Symposium on Contemporary Technology for Animal Genetic Resource (AnGR) Management (21-22nd September, 2022) at ICAR-NBAGR, Karnal.
- Dr. Indrajit Ganguly, PS, ICAR-NBAGR was conferred with Associate Fellow of National Academy of Veterinary Science, India 2021 during 20th NAVS Convocation-cum-Scientific Convention scheduled to be held on 20-21 Jun 2022 at Maharashtra Animal and Fishery Sciences University, Nagpur.
- Dr. M S Tantia, Principal Scientist, ICAR-NBAGR was conferred with ISAGB Fellow during XVI Annual Conference of the Indian Society of Animal Genetics and Breeding (02-03 December 2022), ICAR-DPR, Hyderabad.
- Dr. Sanjeev Singh was conferred upon Associate Fellow of National Academy of Veterinary Science, India 2021 during 20th NAVS Convocation-cum- Scientific Convention scheduled to be held on 20-21 Jun 2022 at Maharashtra Animal and Fishery Sciences University, Nagpur.
- Dr. Amod Kumar: Award of Associate Fellow of National Academy of Dairy Science, India, conferred on October 29, 2022.



Capacity Building

HRD Programme

HRD programme: Scientist/Staff attended

Type of Program	Title	Organizing agency	Duration	Scientist attended
Webinar	How contemporary India interprets gender equality	Azadi ka Amrit Mahotsav lecture series, ICAR-NBAGR, Karnal	14 January 2022	Bureau Staff/ RA/SRF
Webinar	Application of biotechnology for animal productivity enhancement	Azadi ka Amrit Mahotsav lecture series, ICAR-NBAGR, Karnal	25 January 2022	Staff/RA/SRF
Webinar	Pastoralism: Status and Future	Azadi ka Amrit Mahotsav lecture series, ICAR-NBAGR, Karnal	27 January 2022	Staff/RA/SRF
Webinar	Animal identification, animal breeding, and international trade: EU legislation on Zootechnics	Azadi ka Amrit Mahotsav lecture series, ICAR-NBAGR, Karnal	29 March 2022	Staff/RA/SRF
Webinar	Cybersecurity	Azadi ka Amrit Mahotsav lecture series, ICAR-NBAGR, Karnal	01 June 2022	Bureau Staff/ RA/SRF
Workshop	Drafting of Patent Application & Patent Filing Procedure	ICAR-NDRI, Karnal	26 August 2022	Dr R S Kataria Dr Raja K N
SOCDAB-National Symposium	Contemporary Technology for Animal Genetic Resource (AnGR) Management	SOCDAB & ICAR-NBAGR, Karnal	21-22 September 2022	All scientists of the bureau
Workshop	Workshop for Technical Personnel of ICAR Institutes	ICAR-NDRI, Karnal	1-3 December 2022	Sh. Harvinder Singh Sh. Naresh Kumar Sh. Rakesh Kumar
ISAGB Annual Conference	Innovations in Animal Genetics & Breeding for sustainable productivity of livestock and poultry	Indian Society of Animal Genetics & Breeding XVI Annual Conference held at ICAR-DPR, Hyderabad	2-3 December 2022	Dr R S Kataria Dr Raja K N
Training program	Emotional and Social Intelligence at Workplace	ICAR-IIWBR, Karnal, Haryana	13-15 December 2022	Smt. Anita Chanda Smt. Amita Kumari

HRD programme: Scientists contributed (Lecture delivered)

Type of Program	Title of lecture/lead paper	Organizing agency	Duration	Contributed by
National Conference	Exploring heat tolerance and high-altitude adaptation potential in native bovines by exploiting omic data	XXVI Annual convention of Indian Society of Veterinary Immunology & Biotechnology and National Conference on Transforming Livestock Economy through Innovations in Immunology and Biotechnology	3-4 February 2022	Dr Manishi Mukesh
Winter school	Molecular insights on heat tolerance and high-altitude adaptation potential of Indian native cattle	21 days ICAR winter training school organized by Animal Genetics and Breeding, IVRI, Izatnagar	11 February 2022	Dr Manishi Mukesh
State Interface Meet	Strategies for the survey and documentation of Animal Genetic Resources in Madhya Pradesh state	Interface meet for the characterization and documentation of Animal Genetic resources of Madhya Pradesh: A mission towards zero non-descript population	3 March 2022	Dr S K Niranjan
State Interface Meet	Strategies for the survey and documentation of Animal Genetic Resources in Himachal Pradesh state	Interface meet for the characterization and documentation of Animal Genetic resources of Himachal Pradesh: A mission towards zero non-descript population	20 April 2022	Dr Sanjeev Singh
STUTI program of the DST	Molecular approaches in deciphering genome diversity of Indian cattle breeds for their effective conservation	Shoolni University, Himachal Pradesh	21 July 2022	Dr Monika Sodhi
National Symposium	Animal genetic resources (AnGR) management in India: status and way forward.	National Symposium Contemporary Technology for Animal Genetic Resource (AnGR) Management, ICAR-NBAGR, Karnal	21-22 September 2022	Dr B P Mishra
National Symposium	National breed watchlist (2022) and way forward	National Symposium Contemporary Technology for Animal Genetic Resource (AnGR) Management, ICAR-NBAGR, Karnal	21-22 September 2022	Dr R K Pundir
National Conference	Capitalizing indigenous dairy animal in India. In Compendium:	National Conference of Association of Mastitis, DUVASU Mathura	19-20 October 2022	Dr B P Mishra
Training program	NBAGR: An institute of excellence in management of indigenous AnGR	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr B P Mishra

Type of Program	Title of lecture/lead paper	Organizing agency	Duration	Contributed by
Training program	Importance of evolutionary relationship among indigenous AnGR	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr R S Kataria
Training program	Important biomolecules and uniqueness in native breeds with special reference to A1A2 milk	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Monika Sodhi
Training program	Adaptive mechanism of indigenous livestock for changing environmental scenario: An overview	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Manishi Mukesh
Training program	Approaches for genetic characterization of Animal Genetic Resources	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Sonika Ahlawat
Training program	Assisted Reproductive technologies: A tool for indigenous livestock biodiversity conservation	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Sonika Ahlawat
Training program	Reproductive health in dairy animals	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Sonika Ahlawat
Training program	Documentation & registration of AnGR to protect the legal rights of stake holders	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr R K Pundir
Training program	Need for conservation of indigenous AnGR: strategies and it's success stories	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr M S Tantia
Training program	Gene Banks for ex-situ conservation of livestock assets	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr RAK Aggarwal
Training program	Registered breeds of livestock & poultry: An overview	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Raja K N
Training program	Livestock census: Importance & it's role in management of AnGR	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr A K Mishra
Training program	Various approaches for phenotypic characterization of Animal Genetic Resources – Theory & Practical	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Raja K N
Training program	Somatic cell banking- A technology of hope for the future	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Rekha Sharma

CAPACITY BUILDING

Type of Program	Title of lecture/lead paper	Organizing agency	Duration	Contributed by
Training program	Unique attributes of indigenous AnGR - A Case Study on Bandur Sheep	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Reena Arora
Training program	Importance of screening of breeding bulls for genetic disorders	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr S K Niranjan
Training program	Setting conservation strategies for indigenous AnGR: A case study	Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity	14-18 November 2022	Dr Dinesh Yadav
CAFT training	Phenomics data generation on canine Genetic Resource of India: New initiatives for recognizing native dog breeds	CAFT Training program at ICAR-NDRI, Karnal	1 December 2022	Dr Raja K N
CAFT training	DNA based Genetic disorders in dairy cattle: New genomic approaches for their identification.	CAFT Training program at ICAR-NDRI, Karnal	1 December 2022	Dr S K Niranjan
CAFT training	Exploration of Genomic Variant Information using Whole Genome Sequence Data	CAFT Training program at ICAR-NDRI, Karnal	1 December 2022	Dr Amod Kumar
Training programme	Nucleotide sequence alignment and genbank submission	Practical approaches to bioinformatics and Omics Technologies at ICAR-IVRI, Izatnagar	October 10-14, 2022	Dr Mahesh Dige
Training programme	Longitudinal data analysis using random regression model from	Exploring integration of multi-omics and conventional breeding approaches for sustainable livestock production at ICAR-NDRI, Karnal	December 1-21, 2022	Dr Mahesh Dige
National Conference	A mission towards zero non-descript animal genetic resources of India: challenges and opportunities.	ISAGB Annual Conference; ICAR-DPR, Hyderabad	2-3 December, 2022	Dr B P Mishra
National Conference	Epigenetics for improving production and adaptive traits in livestock and poultry	ISAGB Annual Conference; ICAR-DPR, Hyderabad	2-3 December, 2022	Dr R S Kataria
Workshop	Physiological and multi-omics approaches to understand heat stress tolerance and high-altitude adaptation in native animal genetic resources	Indo-Australian workshop held at IVRI, Izatnagar	21-22 December 2022	Dr Manishi Mukesh

Azadi Ka Amrit Mahotsav: Webinar Series

As part of the Azadi Ka Amrit Mahotsav celebrations, a series of webinars were organized at ICAR-National Bureau of Animal Genetic Resources, Karnal. These webinars aimed to commemorate the occasion by sharing knowledge and insights on various topics.

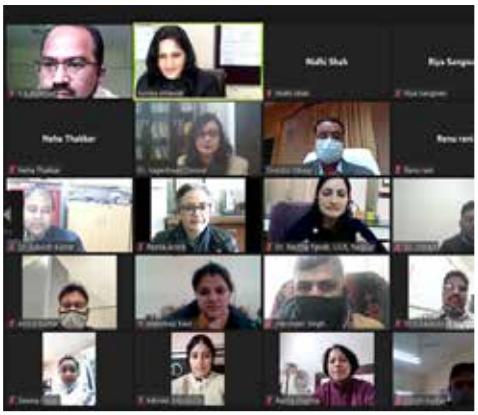
The first webinar, held on January 14, 2022, focused on "How contemporary India interprets gender equality?" The lecture was delivered by Prof. Vageshwari Deswal from Delhi University's faculty of law. This webinar was attended by 74 participants from ICAR institutes, universities, and research institutions.

The second webinar, conducted on January 27, 2022, explored the theme of "Pastoralism: Status and Future." Dr. DK Sadana, retired Principal Scientist and founder of the Indigenous Livestock Society - India, delivered the lecture. A total of 88 participants from various ICAR institutes, universities, and research institutions attended the webinar.

On February 25, 2022, a webinar on "Application of biotechnology for animal productivity enhancement" was conducted. Dr. Subeer S. Majumdar, a distinguished professor from the National Institute of Animal Biotechnology, Hyderabad, shared valuable insights with the 53 participants from ICAR institutes, universities, and research institutions.

The series continued with a webinar on March 29, 2022, focusing on "Animal identification, animal breeding, and international trade: EU legislation on Zootechnics." Dr. Smita Sirohi, Councillor (RG)/ Advisor (Agri. & Marine Products) at the Embassy of India to Belgium, Luxembourg, and the EU, Brussels, Belgium, delivered the lecture. A total of 74 participants from various ICAR institutes, universities, and research institutions attended the webinar.

In addition to the webinars, a lecture on "Cybersecurity" was delivered on June 1, 2022. Sh. Rudra Dev Sharma, Chief Manager at SBI, Model Town Branch, Karnal, shared insights with 35 participants comprising the staff and students of the Bureau.



Symposium and Training Programs

SOCDAB National Symposium

A National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" was organized in collaboration with the Society for Conservation of Domestic Animal Biodiversity (SOCDAB) on September 21-22, 2022, in a hybrid mode.

The Foundation Day Celebration of the institute on 21st September, 2022 and inaugural function of the National Symposium witnessed esteemed dignitaries gracing the occasion including Dr. B N Tripathi, Deputy Director General (Animal Science), ICAR, the Chief Guest, Dr. M S Chauhan, Vice Chancellor of GB Pant University of Agriculture & Technology, Pantnagar, the Guest of Honor, and Dr. M L Madan (Padmashree Awardee), former DDG (AS), ICAR.

The symposium witnessed the participation of around 300 scientists, researchers, academicians, and students from various institutes, including retired faculty members, both in-person and online. Over 200 papers were presented through oral and poster presentations, focusing on contemporary technologies for breed improvement and conservation in three scientific sessions. During the inaugural session, the Chief Guest conferred various Society awards and Fellowships. A Brainstorming Session on Breed Watch List was also held, resulting in valuable recommendations related to improved production, management, and conservation of AnGR in the country. The first-ever National AnGR Quiz Competition was won by the IIVER Rohtak Team. Two scientists were honored with the Young Scientist Award for their scientific papers, while eighteen researchers received awards for their research papers under the oral and poster categories.

AnGR Sensitiz

Capacity Building of Field Veterinary Officers

An online training program on "Capacity Building of Field Veterinary Officers on Management of Indigenous Domestic Animal Diversity" sponsored by MANAGE, Hyderabad was organized by ICAR-NBAGR, Karnal from 14-18th November, 2022. A total of 52 participants from 18 states/ UT attended the program. Aim of the training was to impart knowledge about strategies for characterization and conservation of indigenous AnGR and to ensure their sustainable utilization to the state field functionaries. A total of 20 lectures pertaining to the theme of the training course were delivered by experts from ICAR-NBAGR and other ICAR institutes. During his address to the participants, Dr BP Mishra, Director, ICAR-NBAGR, stressed upon the role of field veterinary officers in accomplishing the "Mission towards zero non-descript AnGR of India" launched by the institute and also for breed wise livestock census. The training program was coordinated by Dr Raja K N, Dr Sonika Ahlawat and Dr MS Dige from ICAR-NBAGR and Dr. Sagar Surendra Deshmukh from MANAGE, Hyderabad. The participants appreciated the efforts of the Bureau in management of AnGR. An e-book titled "Advances in Management of Animal Genetic Resources" containing all lectures of the training course was also published.

Interface meet of Telangana state

In the series of state-specific interface meets under "Mission towards zero non-descript AnGR of India", ICAR-NBAGR organized 7th Interface meet for Telangana state on 10th January, 2022 through online mode. The interface meet with a theme of "Characterization and Documentation of Animal Genetic Resources of Telangana: A Mission Towards Zero Non-Descript Populations" was attended by 223 participants including ICAR Institutes, PV NRTVU, Hyderabad , Directorate of Animal Husbandry and Telangana State Biodiversity Board, Hyderabad, NGOs etc.

Dr BP Mishra, Director, ICAR-NBAGR, Karnal presented the Bureau's activities and strategies for documenting non-descript populations in the country under the mission. Dr. Venugopal, Assistant Director, Animal Husbandry Deptt., Govt. of Telengana provided a glimpse of the status of AnGR of Telangana and discussed the development programs and policies for the AnGR of the state.

Dr. Shilpi Sharma from Telangana State Biodiversity Board, reiterated the need for conservation of indigenous germplasm of Telangana. Dr. B. Ekambaram, Director Research, PV NRTVU gave an presentation on the "Status of AnGR of Telangana"

ation Programs

a Dr RK Pundir, Principal Scientist, ICAR-NBAGR, Karnal suggested the strategies that can be adopted for identification and registration of new populations as distinct breeds. During the interface meet, a panel of experts from ICAR institutes, State Veterinary University, Telangana State Biodiversity Board and WASSAN, Hyderabad provided inputs for documentation of non-descript livestock and poultry genetic resources of the state.

Interface meet of Punjab

Under the Mission Towards Zero Non-descript Animal Genetic Resources, ICAR-NBAGR has organized its 8th State Interface Meet for Punjab on 8th February, 2022, in virtual mode. The meeting on "Characterization and Documentation of Animal Genetic Resources of Punjab" was attended by 49 participants of ICAR, Guru Angad Dev Veterinary & Animal Science University, Animal Husbandry Department, Punjab, NGOs, etc.

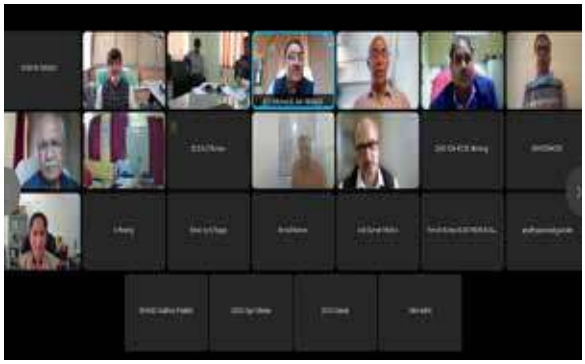
Dr Inderjeet Singh, VC, GADVASU, suggested to register the germplasm, which have been indigenized and improved within the country. Dr V K Saxena, ADG (AP&B), ICAR highlighted the need for using molecular tools for developing breed signatures. Dr HS Kahlon, Director AHD, Punjab

emphasized on specific populations in Punjab for studying in detail.

Dr T K Datta Director ICAR-CIRB underlined the need to develop well defined standard of some of the native breeds like Nili-Ravi buffalo characters. In welcome address, Dr BP Mishra, Director, ICAR-NBAGR briefed the Bureau's activities and described the strategies for achieving the mission. Dr M S Tantia, ICAR-NBAGR, Dr. Simarjeet, GADVASU and Dr Sahil AHD, Punjab also presented various aspects of AnGR management of the Punjab state. A panel of experts provided important inputs for documentation of non-descript AnGR and conservation of native breeds of the state during the meet.

Interface meet of Madhya Pradesh

Tenth state-wise Interface meet was organized by ICAR-NBAGR for Madhya Pradesh through virtual mode on 3rd March, 2022, under "Mission towards zero non-descript AnGR of India". Under the theme "Characterization and Documentation of Animal Genetic Resources of Madhya Pradesh: A Mission Towards Zero Non-Descript Populations", about 140 scientists/academicians/officers of ICAR, NDVASU, Animal Husbandry & Dairying Department-MP (AHDD), MP State Livestock & Poultry Dev. Corp. (MPSLPDC), MP state Biodiversity Board and delegated of NGOs participated in the meet. In welcome address, Dr BP Mishra, Director, ICAR-NBAGR outlined the priorities for management of native AnGR in country. He also delineated the strategies for describing the Non-descript AnGR in the country. Dr V K Saxena, ADG (AP&B), ICAR urged for collaboration of all related agencies for documenting AnGR in the state. Dr R K Mehiya, Director, AHDD offered full



support of the department in fulfilling the task of documenting native AnGR in MP. Dr HBS Bhadoria, MD, MPSLPDC opined about taking necessary steps for breed multiplication and improvement after registration as new breed.

During the meet, a panel of experts of ICAR, NDVASU and NGOs deliberate the strategies for documentation of non-descript AnGR and improvement of native breeds in Madhya Pradesh.

Interface meet on AnGR of West Bengal

ICAR-National Bureau of Animal Genetic Resources, Karnal organized Interface Meet on Animal Genetic Resources of West Bengal on 19th April 2022 through virtual mode. It was 11th state specific Interface meet under the Mission towards Zero Non-Descript AnGR of India and attended by about 200 participants of ICAR, West Bengal University of Animal & Fishery Sciences, Department of Animal Husbandry and Veterinary Services and Animal Resource Development, West Bengal, NGOs, etc. Chief Guest Prof. Chanchal Guha, Hon'ble Vice Chancellor, WBUAFS emphasized the significance of AnGR characterization and conservation, urged for the collaboration of all the related agencies for documenting AnGR in the state. Earlier, Dr. B.P. Mishra, Director, ICAR-NBAGR, Karnal, Haryana outlined the priorities of NBAGR for the management of native AnGR in the country and further outlined the strategies to complete the mission. Dr Yograj Tamang, Director, Animal Husbandry and Veterinary services, Govt. of West Bengal presented the activities of the department. Dr S Pan, WBUAFS presented status of AnGR of West Bengal along with highlighting homogenous populations in the state. A scientific discussion by the expert panel was also held on strategies for documentation of non-descript AnGR of the state during the meet.

Interface meet of Himachal Pradesh

ICAR-NBAGR organized its 12th Interface Meet (online) for 'A Mission towards Zero Non-Descript Population' with Himachal Pradesh state on 20th April 2022. In his address, Dr. Anupam Mital, Joint Director, Department of Animal Husbandry, Government of Himachal Pradesh, underlined the need of adding value to indigenous livestock and poultry genetic resources, branding them, and establishing breed societies. Prof. Mandeep Sharma, Dean, DGCN, COVAS CSKHPKV, Palampur, highlighted the need of local genetic resource characterization, documentation, and registration. Dr Vineet Bhasin, former Principal Scientist, ICAR, New Delhi (INDIA), Consultant, ILRI, emphasised the importance of characterization and registration of large crossbred sheep populations, unique high altitude sheep and goat populations in HP. Dr VK Saxena, ADG (AP&B), ICAR advised exploring non-descript populations in Himachal Pradesh's high altitude regions, ensuring full council support in accomplishing the mission's target of zero non-descript AnGR.

Dr. B P Mishra, Director, ICAR-NBAGR in his welcome address highlighted the bureau's achievements with further envisioning for mission towards zero non-descript AnGR. Experts of NBAGR, CSKHPKV, Department of Animal Husbandry, Government of Himachal Pradesh deliberated on characterization and conservation of native breeds of the state. More than 60 participants of ICAR, CSKHPKV, Palampur and Department of Animal Husbandry, Government of Himachal Pradesh participated in the meet.

Farmer's awareness & outreach Programs

Tripura

Three farmers-scientist interactive meeting camps were arranged in Poangbari & Barakmura, Paharmura and Chulubari villages of Tripura during 8th and 9th March, 2022. A total of 30 beneficiaries belonging to SC category were provided the animal health kits under the SCSP and interacted about importance indigenous livestock & poultry rearing and also about the management and health practices to be followed in the animal husbandry sector. The program was coordinated by Animal Husbandry Department, Tripura.

Sikkim

Farmers Awareness Program on Management of Animal Genetic Resources was conducted in Chalamthang Pacheykhani village East Sikkim district of Sikkim state on 8th March 2022. About 60 farmers were sensitized on management of AnGR by the Bureau scientists. State Animal Husbandry Department also supported in organizing the program.

Haryana

A farmer scientist interactive meet was organized on the topic "Management of indigenous AnGR" at village Nagal, Indri block, district Karnal on 31.03.2022 along with Animal Husbandry Department, Haryana. During the program 63 farmers participated and interacted with the scientist and veterinary officers regarding various management practices followed and also advantages of maintain indigenous livestock breeds, milch cattle in particular. Fifty farmers belonging to SC category were provided with a health kit containing deworming tablets, mineral mixture calcium supplement etc. under SCSP.

In another program, the Bureau sensitized about AnGR management to over 100 farmers and livestock keepers from the village of Gagsina, Karnal, as part of the "Mera Gaon Mera Gaurav" program on 5th December 2022. The event aimed to raise awareness among farmers about importance of indigenous animals and significance of soil health in enhancing farm productivity on the occasion of World Soil Day.

Teams of scientists also visited rural areas of various states and interacted with the livestock owners and veterinary field functionaries. The teams sensitized the people about scientific management of the native AnGR.

Tripura

Haryana

Vichar-gosthi and awareness camp with cattle and yak farmers in Khardung village, Ladakh

Vichar Gosthis and Awareness Camps in Ladakh

Dr BP Mishra, Director and Dr Manishi Mukesh, Principal Scientist of ICAR-NBAGR visited Ladakh during 26 May- 2 June, 2022 and organized *Vichar Gosthi* and awareness camps in different regions of the Union Territory. The camps were organized in association with AHD, Ladakh on 28th May in Khardung for cattle and yak farmers; on 29th May in Hunder (Nubra valley) with double hump camel owners; and on 30th May 2022 in Chibra - Khargyam with yak keepers and Pholonglay - Durbuk with Ladakhi cattle farmers. The keepers were sensitized about importance of native animals which are well adapted to climate of high altitude and produce with least inputs. Farmers in each region were very enthusiastic by the registration of Ladakhi cattle by the Bureau and expressed their happiness about the various activities for its improvement and value addition. Farmers also shared livestock related issues with the scientists and shown interest to develop Breed Associations in the region.

A meeting was also held to discuss implementation of activities under mission toward zero nondescript AnGR with officers of Animal/Sheep Husbandry & Fisheries Department, Ladakh on May 27, 2022. The meeting was attended by Dr Mohd Raza, Director, Animal Husbandry, UT Ladakh; Dr M Iqbal, Chief Animal Husbandry Officer, Leh; officers and field functionaries at block level.

Exhibitions

Bureau regularly participates and organize exhibitions in various extension programs for farmers and stakeholders organized by institutions and State Animal Husbandry Departments. The Bureau demonstrates native animal breeds and their management along with various AnGR activities. During 2022, exhibitions were organized on four occasions and about 21,000 visitors visited the stall.

S.No.	Event	Place	Date	Number of participants
1.	State Livestock show held at Bhiwani	Bhiwani (Haryana)	25-02-2022 to 27-02-2022,	About 20,000 visitors
2.	Pasu Palan Mela	Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab.	22.09.2022 to 23.09.2022	About 500 farmers
3.	Cane fest 2022	ICAR-Sugarcane Breeding Institute, Karnal, Haryana.	12.10.2022	About 300 farmers

Hon'ble Lt Governor and CEC-LAHDC lauded Bureau's efforts on the Mission in Ladakh

Hon'ble Lieutenant Governor of Ladakh (UT) Sh. RK Mathur, in his meeting with ICAR-NBAGR scientists at Raj Niwas on 27 May 2022, lauded the efforts of Bureau for Zero Non-descript AnGR mission in Ladakh and reiterated the full support to Bureau's team to make the Ladakh as first Non-descript AnGR state in country. Dr BP Mishra, Director of the Bureau apprised him about characterization of native AnGR - cattle, yak, donkey, pony, dog of Ladakh done by the bureau in collaboration with local agencies. Governor also showed his keen interest in Bureau's research for improvement and value addition of Ladakhi cattle and yak for economic benefits of people of Ladakh.

Bureau scientists also met with Sh Tyashi Gyalson, Hon'ble Chief Executive Councilor, Ladakh Autonomous Hill Development Council (LAHDC), Leh and briefed him about a decade long research conducted by the Bureau in Ladakh, and informed way forward for the mission in Ladakh. The Hon'ble CEC appreciated the efforts of the Bureau specially characterizing Ladakhi cattle and yak and further working on their milk attributes, which would support the Ladakh farmers. He strongly desired the need for devising development programs for improving Ladakhi cattle and develop a good market for Ladakhi cattle milk to generate good source of income to the local people.

Bureau's scientists also met with Sh Ravinder Kumar, Secretary, Animal and Sheep Husbandry, UT Ladakh and appraised about the scientific accomplishments with respect to Ladakhi cattle, Yak and Zanskar ponies during past and the present activities under the Zero Non-descript AnGR Mission. Appreciated the efforts, he wished to make Ladakh as zero non-descript AnGR with concerted efforts. The team also met Ms Padma Ango, Secretary, Higher Education and Information, UT Ladakh and elucidated various activities initiated on Ladakh animal genetic resources and on-going zero ND mission.

ICAR-NBAGR team with Hon'ble Lt Governor, UT-Ladakh

ICAR-NBAGR team with Sh. Tyashi Gyalson Hon'ble CEC, Leh


Interaction Meet with Farmers


मेरा गांव, मेरा गौरव

Institute's Activities

Celebrations

Kisan Diwas and Breed Conservation Award

The ICAR-NBAGR celebrated "Farmers Day" on 23rd December 2022, bringing together animal breed conservationists to honor and confer the Breed Conservation Award-2022 to livestock keepers and organizations that have made significant contributions to conserving indigenous animal breeds throughout the country. The program witnessed the participation of approximately 200 delegates, both online and offline. Dr. BN Tripathi, Deputy Director General (Animal Science), Indian Council of Agricultural Research, New Delhi, presided over the ceremonial function. He extended his congratulations to the winners and emphasized the importance of promoting native breeds in the country. The chief guest, Dr. AK Srivastava, Vice-Chancellor of Pandit Deendayal Upadhyaya Veterinary University, Mathura, highlighted the significance of preserving native livestock breeds as part of the country's heritage. He commended the stakeholders and organizations for their dedicated conservation efforts. Dr. Dhir Singh, Director of ICAR-National Dairy Research Institute, Karnal, also extended his congratulations to the winners of the Breed Conservation Awards during the event.

During the program, Dr. B.P. Mishra, Director of ICAR-NBAGR, warmly welcomed the delegates from various parts of the country. He emphasized that the Bureau is diligently working towards documenting and conserving indigenous livestock biodiversity through collaborative efforts across the nation. Dr. A.K. Mishra, Principal Scientist, provided an overview of the breed awards and highlighted the record number of applications received this year, reflecting the esteemed reputation and popularity of the award.

List of Awardees

Prize	Awardee	Breed conserved
Individual category		
First	Mr. A. Satish, Madurai (Tamil Nadu)	Chippiparai dog
Second	Mr. Shesh Rao Tukaram Suryavanshi, Latur(Maharashtra)	Deoni cattle
Third	Mr. Srinivasacharya, Mysore (Andhra Pradesh)	Mandya sheep
Consolation	Sh. Durga Ram, Bikaner(Rajasthan)	Magra sheep
Institutional category		
First	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana (Punjab)	Nili Ravi buffalo
	ICAR-Indian Grassland and Fodder Research Institute, Jhansi (Uttar Pradesh)	Bhadavari buffalo
Second	Central Institute for Research on Goat, Mathura (Uttar Pradesh)	Jamunapari goat
	Central Sheep and Wool Research Institute, Avikanagar (Rajasthan)	Malpura sheep
Third	Anand Agriculture University, Anand (Guajarat)	Ankleshwar chicken
	Canine Research and Information Center, Bagalkot (Karnataka)	Mudhol Hound dog
Consolation	Shri Venkateswara Veterinary University, Tirupati (Andhra Pradesh)	Punganur cattle
	Kutch Oont Ucherak Maldhari Sangathan, Kutch, Gujarat	Kharai camel

Celebration of Bureau 39th Foundation Day

ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal celebrated its 39th Foundation Day on September 21, 2022. To commemorate this significant milestone, a National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" was organized in collaboration with the Society for Conservation of Domestic Animal Biodiversity (SOCDAB) on September 21-22, 2022, in a hybrid mode.

The Foundation Day Celebration and inaugural function of the National Symposium witnessed esteemed dignitaries gracing the occasion. Dr. B N Tripathi, Deputy Director General (Animal Science), ICAR, the Chief Guest, applauded the bureau for its remarkable achievements in AnGR management, particularly in germplasm recognition and preservation across the country. He emphasized that with its national and international visibility, the Bureau now carries a greater responsibility and should work with a vision towards 2047. Dr. M S Chauhan, Vice Chancellor of GB Pant University of Agriculture & Technology, Pantnagar, the Guest of Honor, and Dr. M L Madan (Padmashree Awardee), former DDG (AS), ICAR, also commended the Bureau on its 39th Foundation Day. Dr. B P Mishra, Director of the bureau, highlighted the Bureau's notable achievements. He shared that several milestones were accomplished in previous years, including the launch of the Mission towards Zero Non-descript AnGR in India.

During the foundation day celebrations, deserving staff members were honored for their outstanding work throughout the year. Dr. Raja K N received the prestigious PG Nair Award for outstanding scientific contribution in 2022. Additionally, Mrs. Anita Chanda, Mrs. Parvesh Kumari, and Mr. Krishan Lal were recognized and awarded for their exceptional contributions.

Celebration of the International Biodiversity Day

The ICAR-National Bureau of Animal Genetic Resources exuberantly celebrated the International Biodiversity Day on May 21st and 22nd , 2022. This significant occasion aimed to raise awareness about the importance of safeguarding global biodiversity. Under the theme "Building a shared future for all life," the institute organized a poster and impromptu speech competition on May 21st, 2022, aligning with the current theme to create widespread awareness about the significance of this day. The competitions attracted around 100 enthusiastic participants from ICAR-NDRI and ICAR-NBAGR, fostering a sense of collective responsibility towards biodiversity conservation.

On May 22nd, a webinar was held on topic titled "Animal Genetic Resource Biodiversity for Building a shared future for all life," delivered by the esteemed Director of ICAR-NBAGR, Dr. B.P. Mishra. Dr. Mishra highlighted the criticality of indigenous livestock diversity in fostering sustainable development. The webinar garnered the active participation of 47 attendees, including scientists, research scholars, students, and technical staff from the Bureau, as well as other ICAR institutions.

Republic Day celebration at the Bureau campus

The bureau staff celebrated the 73rd Republic Day on 26th January 2022 in the bureau campus following COVID-19 protocol. Director, NBAGR unfurled the National Flag on the occasion. During the celebration, the Best Division and Section Awards were conferred, acknowledging work and contributions. Furthermore, employees from various categories including Technical, Administration, and Supporting staff were recognized for their dedication.

Celebration of International Yoga Day

The Bureau celebrated International Yoga Day on June 21, 2022, embracing the spirit of health and well-being. A rejuvenating Yoga session was organized within the campus, attracting the participation of scientists and other staff members.

Participants immersed themselves in various Yoga postures, breathing exercises, and meditation, promoting physical fitness and mental harmony.

Independence Day Celebration

The Bureau celebrated the 76th Independence Day and the event commenced with the unfurling of the national flag by the esteemed Director of the institute. Following the flag hoisting ceremony, a vibrant cultural program was organized, showcasing the diverse talents staff members. Additionally, the staff actively participated in the "Har Ghar Tiranga" initiative from13th to the 15th of August, 2022, celebrating the spirit of Independence by displaying the national flag in their homes.

Special Campaign 2.0 & Fit India Freedom Run 3.0

ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal has organized the Special Campaign 2.0 for the disposal of pending matters from 2nd to 31st October 2022. This month-long campaign commenced with the 'Swachhata Abhiyaan' on 2nd October 2022, in commemoration of Gandhi Jayanti, as initiated by the Government of India.

The NBAGR in Karnal kicked off the 'Swachhata Abhiyaan' by cleaning the roadside footpath along National Highway-44, near the institute's entrance, to enhance the overall aesthetics of the office premises. The staff members, including both permanent and contractual employees, enthusiastically participated in the Swachhta campaign, demonstrating their commitment to cleanliness.

Following the cleanliness drive, a fit India Freedom Run was organized within the NBAGR premises. The fit India movement, a public initiative conceptualized by the Government of India, aims to inspire citizens to lead more active and physically fit lifestyles. The Director of the Institute led team NBAGR during the run, promoting the importance of walking and running for improved health and fitness. Additionally, the staff members were encouraged to engage in regular exercise, participate in recreational sports activities, and practice yoga to maintain their fitness levels.

Vigilance awareness week

The Vigilance Awareness Week was observed at ICAR-NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES (NBAGR), Karnal from 26th Oct. to 1st Nov., 2022. The staff of NBAGR was administered

Integrity Pledge on 26.10.2022 at 11:00 AM by the Director, NBAGR. He also brief focused area i.e. "Corruption free India for a developed Nation (भ्रष्टाचार मुक्त भारत – विकसित भारत) for observing Vigilance Awareness Week this year. The lecture on the topic "Vigilance Awareness and its set up in ICAR" was arranged at the institute. One Gram Sabha awareness meeting was organized on 15.11.222 at Dadupur village of Karnal.

World Soil Day

The Bureau celebrated "World Soil Day" by engaging with over 100 farmers and livestock keepers from the village of Gagsina, Karnal, as part of the "Mera Gaon Mera Gaurav" program. The event aimed to raise awareness among farmers about the significance of soil health in enhancing farm productivity and the importance of indigenous animals in the face of changing climate conditions. During the program, valuable information and strategies were shared with the farmers, highlighting the various approaches to maintaining soil health.

Women Farmers Day

ICAR-NBAGR, Karnal celebrated "Women Farmers Day (Mahila Kisan Diwas)" with women farmers from different villages of Karnal on 16th October 2022. During the event, the contribution of women farmers in agriculture and livestock rearing was acknowledged. Lectures on organic farming and integrated farming were delivered to the participants by the Bureau scientists. About 150 women farmers attended the event.

World Food Day

ICAR-NBAGR, Karnal celebrated "World Food Day" on 16th October, 2022 with the staff and students of Government Senior Secondary School, Village Subri, Karnal. During the discussion, awareness was created about the contribution of farmers in ensuring the nutritional security of the country. In addition, varieties of agricultural crops and technologies developed by ICAR were highlighted. Students were also apprised about the importance of balanced diet in leading a healthy diet. About 100 students and staff participated in the event.

Meetings

RAC meeting

Online meeting of Research Advisory Committee (RAC) of ICAR-NBAGR was held on 22nd Feb., 2022. The meeting was chaired by Dr. P Thangaraju, Former Vice Chancellor TANVAS, Chennai wherein current research programmes along with future activities of the institute were discussed.

IRC Meeting

The Institute Research Committee (IRC) meeting was held on 29th April, 2022 under the chairmanship of Dr. B..P Mishra, Director, ICAR-NBAGR; wherein the ongoing and completed research projects were reviewed. New project proposals were also discussed during the meeting.

Interactive meeting with DAHD

An interactive meeting with Animal Husbandry Statistics division of Department of Animal Husbandry & Dairying, Govt. of India for preparatory activity of 21st livestock census was held on 22nd November 2022 at the bureau. Mr. Sumedh Nagrare, Advisor (Stat), DAHD represented the AHS, DAHD and discussed about breed characterstics of indigenous breeds for Next livestock census.

IMC meeting

The Meeting of Institute Management Committee (18th) of NBAGR was held on 19th July, 2022 under the chairmanship of Director, NBAGR. Decisions pertaining to administrative and financial matters of the institute were taken during the meeting.

Breed Registration Committee Meeting

Breed Registration Committee meeting Ninth (10th) Breed Registration Committee (BRC) meeting was held on 31.7.2022 under the chairmanship of Dr. B N Tripathi, DDG (AS) ICAR. Ten new breeds of indigenous livestock were registered, including three breeds of cattle: Kathani cattle (Maharashtra), Sanchori cattle (Rajasthan), and Masilum cattle (Meghalaya), one breed of buffalo: Purnathadi buffalo (Maharashtra), three breeds of goat: Sojat goat (Rajasthan), Karauli goat (Rajasthan), and Gujari goat (Rajasthan), and three breeds of pigs: Banda pig (Jharkhand), Manipuri Black pig (Manipur), and Wak Chambil pig (Meghalaya).

Usilampatti man owning 100 native dog breeds bags 'Breed Conservation Award 2022'

A. Santosh, winner of Breed Conservation Award, tends to over 100 indigenous dogs at Chithi Kennel in Madurai district. | Photo Credit: R. ASHOK

Amid lush and sprawling fields that covers the foothills of Puthur Malai in a quaint village in Usilampatti in Madurai district, the barking of a pack of dogs overpowers the chirping birds.

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Mysuru farmer bags ICAR's award for conservation of Bandur sheep

Acharya said his farm, spread across 30 acres of organically maintained agriculture land, was started in 2012.

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NBAGR in Karnal confers Breed Conservation Awards on Kisan Diwas

CHANDIGARH: ICAR-National Bureau of Animal Genetic Resources (NBAGR) in Haryana's Karnal organized Breed Conservation Award in hybrid modes and

समय जगत

ग्रासलैण्ड को मिला भदावरी भैंस संरक्षण का प्रथम पुरस्कार

உசிலம்பட்டியில் 100 நாட்டு நாய்களை வளர்ப்பவருக்கு விருது

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SCIENTIFIC STAFF

S. No.	Name of Scientist	Designation
1	Dr. B.P.Mishra	Director
2	Dr. M.S. Tantia	Principal Scientist
3	Dr. R.A.K. Aggarwal	Principal Scientist
4	Dr. R.K. Pundir	Principal Scientist
5	Dr. R.S. Kataria	Principal Scientist
6	Dr. Anil Kumar Mishra	Principal Scientist
7	Dr. Monika Sodhi	Principal Scientist
8	Dr.H.K.Narula	Principal Scientist
9	Dr. Satpal Dixit	Principal Scientist
10	Dr. Dinesh Kumar Yadav	Principal Scientist
11	Dr. Reena Arora	Principal Scientist
12	Dr. Manishi Mukesh	Principal Scientist
13	Dr. Avnish Kumar	Principal Scientist
14	Dr. Rahul Behl	Principal Scientist
15	Dr. Rekha Sharma	Principal Scientist
16	Dr.Bina Mishra,	Principal Scientist
17	Dr. Saket Kumar Niranjan	Principal Scientist
18	Dr. Indrajit Ganguly	Principal Scientist
19	Dr. Sanjeev Singh	Principal Scientist
20	Dr. Karan Veer Singh	Principal Scientist
21	Dr. K.N. Raja	Senior Scientist
22	Dr. Sonika Ahlawat	Senior Scientist
23	Dr. Dige Mahesh Shivanand	Scientist
24	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
4	Sh. Harvinder Singh	Asstt. Chief Technical Officer
5	Sh. Jamer Singh	Technical Officer
6	Sh. Sat Pal	Technical Officer
7	Sh. Ramesh Kumar	Technical Officer
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
9	Sh. Satish Kumar	Assistant
10	Sh. Shiv Chander	Upper Division Clerk
11	Smt. Neerja Kaul	Upper Division Clerk
12	Sh. Babu Ram (*Promoted to the post of UDC wef 14.01.2022)	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

Joining

Dr. H.K. Narula, Principal Scientist joined ICAR-NBAGR on 02-05-2022

Dr. Bina Mishra, Principal Scientist joined ICAR-NBAGR on 23-12-2022

Sh. Anil Kumar, Joined as AO, ICAR-NBAGR on 22.05.2022

Sh. Randhir Singh, Joined as FAO, ICAR-NBAGR on 22.05.2022

Distinguished Visitors

Dr. V.K. Saxena, ADG (AP&B), Indian Council of Agricultural Research, Krishi Bhawan, New Delhi visited on 17-18.02.2022 and 21.9.2022.

Sh. Pankaj Kumar, Director (AS), Indian Council of Agricultural Research, Krishi Bhawan, New Delhi visited on 19.05.2022.

Sh. G.P. Sharma, Director (Fin.), Indian Council of Agricultural Research, Krishi Bhawan, New Delhi visited on 04.06.2022.

A Group of 20 students of Diploma courses under NSQF scheme of UGC for understanding the importance of animal genetic resources from Guru Nanak Khalsa (PG) College, Yamunanagar visited on 04.06.2022.

Mr. Mariano J. Beillard, Senior Regional Agricultural Attache and Dr. Santosh Kumar Singh, Senior Agricultural Specialist of U.S. Embassy, New Delhi visited on 22.06.2022.

Dr. Yash Pal, Director (Act.), NRC for Equines, Hisar visited on 19.07.2022.

Dr. Prashant Yogi, Member IMC and RAC of NBAGR visited on 08.09.2022.

Dr. M.L. Madan, Former DDG (AS) visited on 21.09.2022.

Dr.B.N.Tripathi, DDG (AS) visited on 21.09.2022 and 23.12.2022.

Dr. M.S.Chauhan, Vice Chancellor, GBPUAT visited on 21.09.2022.

Shri Dharam Pal Singh, Hon'ble Minister of Animal Husbandry, Dairy Development, Uttar Pradesh Government visited on 07.10.2022.

Mr. Sumedh Nagrare, Advisor(Stat) along with his team - Mr. Vishwanath Pratap Singh, Director, Mr. Dipankar Mitra, Asst. Director, Ms. Shraddha Pal, Asst. Director, Mr. Sunil Kumar, Sr. Statistical Officer from Deptt. of Animal Husbandry & Dairying visited on 22.11.2022.

20 participants of 36th National Training Programme on "Exploring integration of mutiomics and conventional breeding approaches for sustainable livestock production" organized by NDRI visited NBAGR on 19.12.2022.

Dr.A.K. Srivastava, Hon'ble Vice-Chancellor, DUVASU, visited on 23rd December, 2022.

Dr. (Mrs.) Hema Tripathi, National Coordinator (M&E and ESS), ICAR visited on 23rd December, 2022.

राजभाषा प्रकोष्ठः गतिविधियां

संस्थान राजभाषा कार्यान्वयन समिति की बैठक

संस्थान में राजभाषा हिंदी के प्रचार-प्रसार और इसके प्रगामी प्रयोग की प्रगति को बल देने हेतु संस्थान राजभाषा कार्यान्वयन समिति की बैठकें आयोजित की गई. इस वर्ष अक्तुबर से दिसंबर की तिमाही की बैठक 7-2-2022, 12-05-2022, 26-07-2022, 03-11-2022 को समिति कक्ष में आयोजित की गई. बैठक के दौरान संस्थान में राजभाषा हिंदी के प्रगामी प्रयोग की प्रगति की समीक्षा की गई और इसके प्रचार-प्रसार एवं प्रगामी प्रयोग को बल देने हेतु विभिन्न निर्णय लिए गए.

हिंदी कार्यशाला का आयोजन

संस्थान में राजभाषा हिंदी के प्रचार-प्रसार के क्रम में दिनांक 26-3-2022 को "राजभाषा हिंदी : नियम, विनियम एवं अधिनियम" विषय पर हिंदी कार्यशाला का आयोजन किया गया जिसमे मुख्य वक्ता के रूप में श्री धीरज शर्मा, उप-निदेशक (राजभाषा), राष्ट्रीय डेरी अनुसंधान संस्थान करनाल को आमंत्रित किया गया. इस कार्यशाला के दौरान ही हिंदी अनुवाद व हिंदी टंकण के बारे में भी सरल विधियों से ब्यूरो स्टाफ को अवगत करवाया. इसी कर्म में एक और हिंदी व्याख्यान कार्यशाला दिनांक 19-5-2022 को "तनाव रहित जीवन" विषय पर आयोजित की गई. इस कार्यशाला में भारतीय प्रशासनिक सेवा के एक सेवानिवृत्त अधिकारी श्री सीताराम मीणा 22 अधिकारीयों/कर्मचारियों ने भाग लिया. सभी स्टाफ सदस्यों ने इस कार्यशाला को ज्ञानवर्धक बताया.

पशुधन प्रकाश पत्रिका के पुरस्कृत लेख

प्रथम पुरस्कार : "पशुधन से प्राप्त दूध : रोगाणुरोधी पेप्टाइड का समृद्ध स्त्रोत" लेखक सोनिका अहलावत, अनिशा कुमारी, रेखा शर्मा, रीना अरोड़ा, अन्नू शर्मा एवं साईं सत्यनारायण, भाकृअनुप-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल.

द्वितीय पुरस्कार : "पशुधन क्षेत्र में आर्थिक और व्यापारिक अवसरों का दोहन" लेखक: राका सक्सेना एवं सोनिया चौहान, भाकृअनुप-राष्ट्रीय कृषि आर्थिकी एवं नीति अनुसंधान संस्थान, नई दिल्ली.

तृतीय पुरस्कार : "ब्रोकपा और याक : जीवन जीने की एक कला", लेखक: अनीत कौर, जोकेन बाम, मार्टिना पुख्रम्बम, दिनमणि मेधि, ख्रेन्गुनुओ मेफफुओ, मोख्तार हुसैन, विजय पाल एवं मिहिर सरकार, भाकृअनुप-राष्ट्रीय याक अनुसंधान केंद्र, दिरांग (अ.प्र.)

हिंदी पखवाड़े का आयोजन

प्रत्येक वर्ष की भांति इस वर्ष भी संस्थान में हिंदी पखवाड़ा 1-14 सितंबर 2022 तक बड़े उत्साहपूर्वक मनाया गया. इस आयोजन के अंतर्गत संस्थान में विभिन्न हिंदी लेखन की एवं मौखिक प्रतियागितायें करवाई गई. यह पूरा आयोजन निदेशक महोदय द्वारा गठित "हिंदी पखवाड़ा आयोजन समिति" की देख-रेख में करवाया गया जिसके अध्यक्ष डॉ. अनिल कुमार मिश्र,

प्रधान वैज्ञानिक रहे. समिति के सदस्यों में डॉ. संजीव कुमार सिंह, प्रधान वैज्ञानिक, डॉ एच.के.नरूला, प्रधान वैज्ञानिक एवं श्री अनिल कुमार, प्रशासनिक अधिकारी तथा श्री सतपाल, तकनीकी अधिकारी/नामित राजभाषा अधिकारी, सदस्य सचिव रहे.

दिनांक 1 सितंबर 2022 को पूर्वान्ह 11.30 बजे निदेशक महोदय की उपस्थिति में प्रतियोगिताओं का शुभारम्भ किया गया. प्रथम प्रतियोगिता में हिंदी निबन्ध लेखन का आयोजन किया गया, जिसका विषय :स्व-रोज़गार हेतु भारतीय पशु जैव-विविधता" था. इस प्रतियोगिता में कुल 14 प्रतिभागियों ने भाग लिया. इस प्रतियोगिता में प्रथम स्थान पर श्रीमती अनीता चंदा, द्वितीय स्थान पर सुश्री सुषमा प्रसाद और तृतीय स्थान पर श्री रमेश कुमार रहे.

दिनांक 3 सितंबर 2022 को पूर्वान्ह 11.30 बजे हिंदी पत्र लेखन प्रतियोगिता का आयोजन किया गया. इसका विषय "निदेशक राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो की ओर से निदेशक राष्ट्रीय राजमार्ग प्राधिकरण को एक पत्र लिखिए जिसमे संस्थान में होने जा रहे अंतर्राष्ट्रीय सम्मलेन से पूर्व संस्थान के समक्ष राष्ट्रीय राजमार्ग की साफ-सफाई हेतु लिखें" रखा गया था. इस प्रतियोगिता में कुल 9 प्रतिभागियों ने भाग लिया. इस प्रतियोगिता में प्रथम स्थान पर श्रीमती अमिता कुमारी, द्वितीय स्थान पर श्री रमेश कुमार और तृतीय स्थान पर श्रीमती अनीता चंदा रहे.

दिनांक 5 सितंबर 2022 को पूर्वान्ह 11.30 बजे हिंदी टिप्पणी मसौदा लेखन प्रतियोगिता का आयोजन किया गया. इसका विषय इस प्रतियोगिता में प्रथम स्थान पर श्री रमेश कुमार, द्वितीय स्थान पर श्रीमती अनीता चंदा और तृतीय स्थान पर श्री योगेन्द्र रहे.

दिनांक 7 सितंबर 2022 को पूर्वान्ह 11.30 बजे शब्दार्थ एवं अनुवाद प्रतियोगिता का आयोजन किया गया. इसके साथ एक अंग्रेजी पैरा का हिंदी में अनुवाद करना था. इस प्रतियोगिता में कुल 9 प्रतिभागियों ने भाग लिया. इस प्रतियोगिता में प्रथम स्थान पर डॉ. रणजीत कटारिया, द्वितीय स्थान पर सुश्री अनीता चंदा और 2 प्रतिभागी तृतीय स्थान पर श्री योगेन्द्र एवं श्री राकेश कुमार रहे.

दिनांक 9 सितंबर 2022 को पूर्वान्ह 11.30 बजे संस्थान में आशू भाषण प्रतियोगिता का आयोजन किया गया. इस प्रतियोगिता में कुल 17 प्रतिभागियों ने भाग लिया. पूरा

कार्यक्रम बड़ा ही रोचक रहा जिसे सभी ने सराहा. इस प्रतियोगिता में प्रथम स्थान पर सुश्री अंकिता, द्वितीय स्थान पर डॉ. महेश शिवानन्द डिगे और तृतीय स्थान पर श्रीमती अनीता चंदा रहे. प्रतियोगिता में अहिन्दी भाषी क्षेत्र से डॉ. के.एन. राजा ने भाग लिया और उन्हें प्रोत्साहन पुरस्कार प्राप्त हुआ.

दिनांक 12 सितंबर 2022 को पूर्वान्ह 11.30 बजे संस्थान के वैज्ञानिकों तकनीकी वर्ग और आरए/एसआरएफ/ शोध छात्रों के लिए "भारतीय अर्थ-व्यवस्था में गोवंश का योगदान" विषय पर आधारित पोस्टर प्रतियोगिता का आयोजन किया गया. इस प्रतियोगिता में प्रथम स्थान पर सुश्री विधि गर्ग, द्वितीय स्थान पर राशी विशिष्ठ रहे और प्रोत्साहन पुरस्कार सुश्री पल्लवी राठी ने प्राप्त किया.

दिनांक 14 सितंबर 2022 को पूर्वान्ह 11.30 बजे "उत्कृष्ट हिंदी कार्मिक वर्ष 2021-22" के चयन हेतु पूर्व गठित समिति के द्वारा मूल्यांकन किया गया. इस प्रतियोगिता में प्रथम स्थान पर श्री बाबू राम और द्वितीय स्थान पर श्री नरेश कुमार रहे.

दिनांक 22 सितंबर 2022 को राजभाषा पुरस्कारों का वितरण किया गया. इस अवसर पर डॉ. वी.के. सक्सेना, सहायक उप-महानिदेशक, मुख्य अतिथि के रूप में उपस्थित रहे.

राष्ट्रीय स्तर की हिंदी कार्यशालाओं में प्रतिभागिता

भारतीय कृषि अनुसंधान परिषद् और केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर (पश्चिम बंगाल) में संयुक्त रूप से 24-25 अगस्त 2022 तक आयोजित दो दिवसीय "भाषा उत्सव एवं संगोष्ठी" में श्री सतपाल ने भाग लिया.

राजभाषा विभाग द्वारा सूरत (गुजरात) में 14-15 सितंबर 2022 तक आयोजित "दो दिवसीय अखिल भारतीय राजभाषा संगोष्ठी एवं हिंदी दिवस समारोह" में डॉ. अनिल कुमार मिश्र एवं श्री सतपाल, नामित राजभाषा अधिकारी ने भाग लिया.

हिन्दी में उत्कृष्ठ कार्य हेतु संस्थान राजभाषा शील्ड पुरस्कार से सम्मानित

वर्ष 2021-22 के दौरान राजभाषा में उत्कृष्ठ कार्य हेतु राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो को नगर राजभाषा कार्यान्वयन समिति (करनाल) द्वारा राजभाषा शील्ड (द्वितीय) पुरस्कार से सम्मानित किया गया. यह पुरस्कार नगर राजभाषा कार्यान्वयन समिति (करनाल) की दिनांक 7.6.22 को राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल में सम्पन्न हुई 75वीं बैठक में प्रदान किया गया. संस्थान की तरफ से यह पुरस्कार डॉ बी पी मिश्रा, निदेशक, डॉ अनिल कुमार मिश्र प्रधान वैज्ञानिक एवं श्री सतपाल, तकनीकी अधिकारी एवं नामित राजभाषा अधिकारी ने ग्रहण किया.

वर्ष 2021-22 के दौरान संस्थान की हिन्दी पत्रिका पशुधन प्रकाश को नगर राजभाषा कार्यान्वयन समिति (करनाल) द्वारा द्वितीय पुरस्कार प्रदान किया गया.

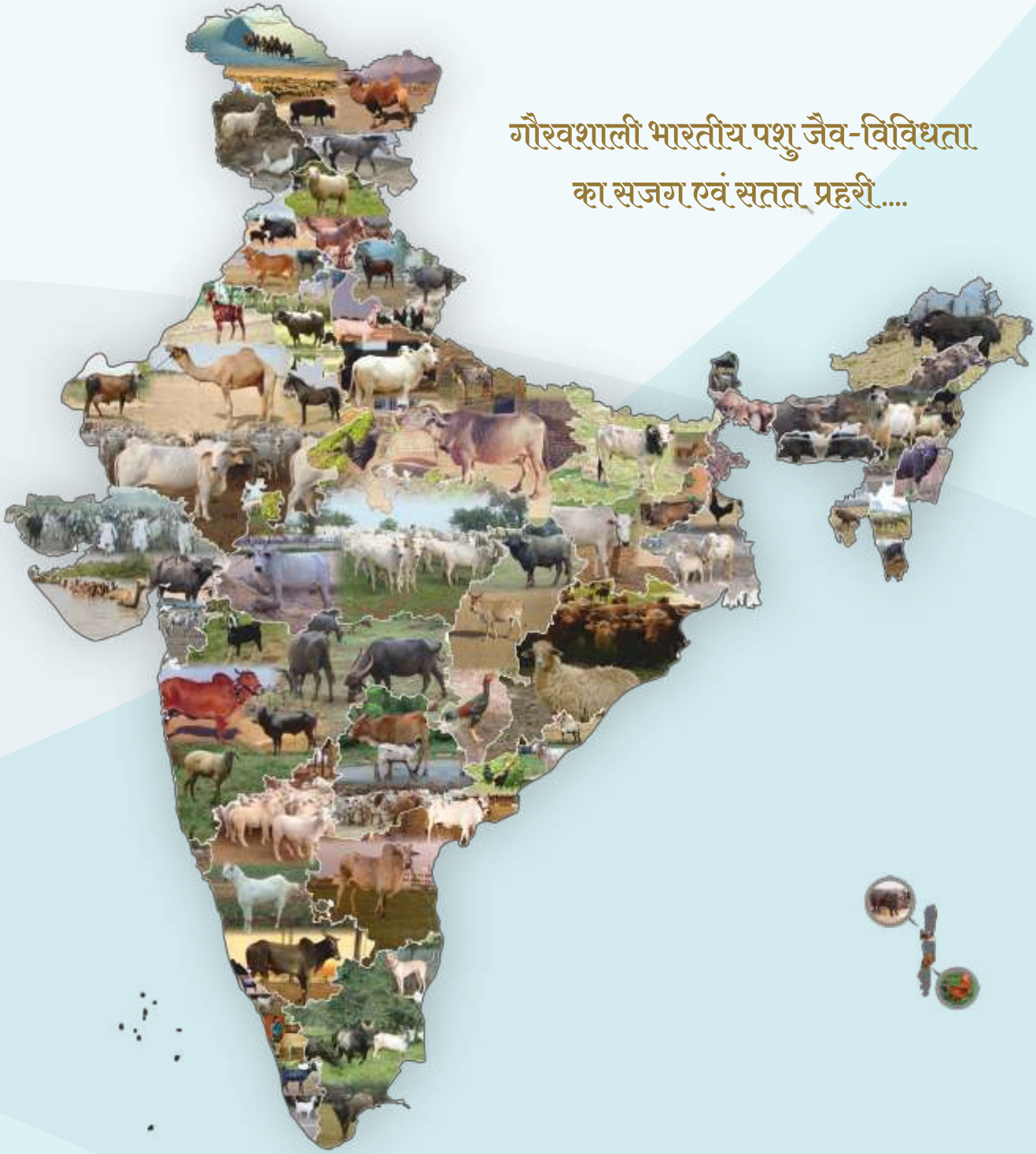
2 ZERO HUNGER

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.*



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

ICAR-NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES

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Twitter: @IcarNbagr

Facebook: https://www.facebook.com/people/Icar-nbagr-Karnal-India/100056955934193/

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