

Review

Indigenous Livestock Wealth of Uttar Pradesh and Uttarakhand States of India - Status and Prospects for Characterization

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ABSTRACT

Uttar Pradesh and Uttarakhand, the northern states of India, together occupy almost 9% of the total land area of the country. The topography includes fertile plains and hilly areas. This land is endowed with enormous biodiversity of livestock genetic resources. Unfortunately, only 15 breeds have so far been registered from this region, 12 from Uttar Pradesh and only 3 from Uttarakhand. These animal genetic resources evolved in the local environment, provide livestock products, promising assets during agriculture crisis and may have unique characteristics like disease resistance, thermo-tolerance, medicinal value of meat and milk and utilization of low-quality feed. Their full economic potential cannot be exploited until they are characterized. Since livestock diversity is declining rapidly world-wide, the need of hour is to characterize, document and conserve the diversity of our animal genetic resources. As per the latest livestock census (2019), Uttar Pradesh and Uttarakhand possess 68 million and 4.4 million livestock population, respectively. Despite huge livestock population in Uttar Pradesh and enormous biodiversity in Uttarakhand, the number of registered breeds are very less. In this review, we have summarized the status and prospects of animal genetic resources of two Indian states. Recent trends and conservation required for their better utilization have also been included. This comprehensive information would help researchers, activists and policy makers involved in characterization and conservation of livestock genetic resources.

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INTRODUCTION

India is endowed with vast animal genetic resources with unique characters and attributes. These indigenous or native breeds have evolved over a period of time in their agro-ecological or local environments (Hanotte and Jianlin, 2005) and have unique features like thermo-tolerance, disease resistance, medicinal value of meat and milk etc. Along with livelihood and food security, livestock also contribute as valuable assets and safety during agriculture crisis. As per latest livestock census, India has 536.76 million total livestock population which showed an increase of 4.8 percent over previous census (BAHS, 2019). Interestingly, total livestock population has increased more in urban area (11.29%) as compared to rural area (4.56%). Further, overall cattle, buffalo, goat and sheep populations have also increased by 1.3, 1.1, 10.1 and 14.1 percent, respectively, over the last livestock census. This upward direction of livestock population indicates that animal rearing has been a beneficial enterprise that has received support from central and state government schemes in animal husbandry sector.

Uttar Pradesh is one of the largest states of India which covers approximately 240,928 square kilometers of area (Latitude: 27° 40' N, Longitude: 80° 00' E). Uttar Pradesh has largest livestock population (68 million) in India. It is a proud custodian of 19 million cattle, 33 million buffaloes, 1 million sheep, 14.5 million goats, 12.5 million poultry, 0.41 million pigs, 0.09 million mules and 0.76 million horses (BAHS, 2019). Despite this huge livestock population and geographical area, Uttar Pradesh has lesser number of characterized animal breeds. Therefore, efforts for identification and characterization of lesser known or unknown livestock populations need to be enhanced. Uttarakhand covers approximately 53,483 square kilometers (Latitude: 30° 15' N, Longitude: 79° 15' E) and contains approximately 4.4 million livestock and 5 million poultry population. Out of the total livestock population, cattle, buffaloes, sheep, goats, pigs, mules, horses and ponies contribute approximately 1.85, 0.87, 0.28, 1.4, 0.02, 0.03, 0.007 million, respectively. Despite the large ecological biodiversity, only three breeds one each of cattle, goat and chicken are registered till date. The available livestock biodiversity in these two states provides

enough scope for characterization and conservation of lesser known or unknown livestock populations.

However, on the other hand, rapid decline in livestock diversity world-wide is of utmost concern. It has been reported that the presumed wild ancestors of many livestock species are endangered or extinct, except red jungle fowl and wild boar. Moreover, it has been estimated that one or two breeds become extinct every week in domestic livestock populations (Schearf *et al.*, 2003). A decline in indigenous livestock populations has also been observed in Uttar Pradesh and Uttarakhand. Use of exotic and commercial breeds for increasing production is the major cause of genetic erosion of indigenous livestock in these states. Developing countries like India should take necessary action to stop replacement and dilution of present registered breeds and characterize and document lesser-known animal breeds. This review discusses the present status and prospects of livestock genetic resources of Uttar Pradesh and Uttarakhand states of India.

Trends in Livestock and Poultry Population of Uttar Pradesh and Uttarakhand

According to the 20th livestock census, the total buffalo population of Uttar Pradesh was 33 million, while that of cattle was 18.78 million (BAHS, 2019). With 24% of the total buffalo population of India, Uttar Pradesh has the highest population density of buffaloes in the country. Uttar Pradesh is a frontrunner in both meat and milk production having the highest share of 15.1% and 16.3% respectively, among all other Indian states. Among cattle, the larger proportion of milk produced is contributed by cross-bred and exotic animals. In 2018-19 only 5.2 million indigenous cows were recorded in milk, with a production of 273.05 thousand tones. There has been a worrisome decline of 3.93% in the total indigenous cattle population of Uttar Pradesh with a concomitant increase of 64.63% in exotic and cross-bred animals. Similarly, the indigenous sheep, pig and goat population is also on the decline (BAHS, 2019). The declining trend of these indigenous breeds might be due to their less production potential and easy availability of highly productive crossbred animals. However, it is worth noting that there has been an increase of 7.81% in the number of buffaloes from 2012 to 2019. The increasing trend of buffalo population might be due to higher price of buffalo milk as compared to cattle and larger exports of carabeef to the other countries.

Uttarakhand is also very rich in livestock diversity and contains all domesticated livestock species i.e. buffalo, cattle, goats, sheep, poultry, yak etc. Out of the total livestock population, buffalo (0.87 million) and indigenous cattle (1.85 million) population were found to be reduced by 12.3 % and 7.95 %, respectively,

as compared to previous census. Adaptability of buffaloes in the hilly terrain and low production and crossbreeding in indigenous cattle might be the speculated reasons for their decline. Similarly, indigenous pig and sheep populations have also declined by 23.08 % and 13.67 %, respectively. The declining trend of these populations might be due to low production potential and non-availability of structured market for mutton and pork.

The percent contribution of different livestock species in the total livestock population of Uttar Pradesh and Uttarakhand have been summarized in Fig 1 (A) and Fig 1 (B), respectively. In Uttar Pradesh, buffaloes are the major livestock population while in Uttarakhand cattle are predominant. Cattle are well adapted to hilly areas which might be the possible reason for high cattle population in the Uttarakhand.

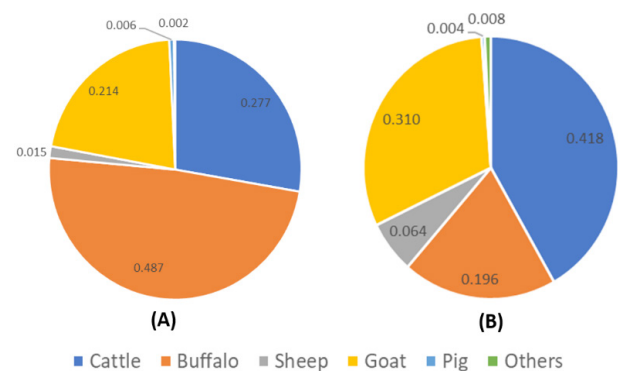


Fig. 1: Contribution of different livestock species in the total livestock population of Uttar Pradesh (A) and Uttarakhand (B)

Registered Livestock Breeds of Uttar Pradesh and Uttarakhand

Uttar Pradesh is habitat to twelve livestock breeds that have been registered by the National Bureau of Animal Genetic Resources, Karnal. These breeds have been notified in the Gazette of India No. 3364, published on 14th October, 2019. Registration of these breeds is based on extensive surveys, documentary evidence, a population of least 1000 animals, as per guidelines issued by ICAR-NBAGR, Karnal (<http://www.nbagr.res.in/Guideliens%20for%20Breed%20Reg.pdf>). The registered livestock wealth of Uttar Pradesh includes five cattle, one breed each of buffalo and pig, two sheep breeds and three goat breeds. Haryana (cattle breed) from Haryana state also share their habitat in the adjoining areas. Badri cattle, Uttara chicken, Chaugarkha and Pantja goats are the breeds registered from Uttarakhand.

Bhadawari Buffalo

It is the only registered buffalo breed from Uttar Pradesh. Etawah district of Uttar Pradesh is considered to be the main breeding tract of this breed (Kushwaha

et al., 2007). The average milk yield per lactation of Bhadawari buffaloes is around 1500 kg while average fat, SNF, protein and lactose in milk were 8.26, 9.57, 4.05 and 5.23%, respectively. Due to less milk production, short coming of breeding bulls and infiltration of Murrah buffaloes to upgrade the local buffaloes, Bhadawari buffalo population has shown declining trend.

Kenkatha Cattle

The name of breed has been taken from Ken River which separates Uttar Pradesh and Madhya Pradesh states. Mainly found in the Hamirpur district of Uttar Pradesh, and reared for draught purpose (Pundir *et al.*, 2007).

Kherigarh Cattle

Kherigarh cattle are mainly distributed in the Lakhimpur Kheri district of Uttar Pradesh. This breed is also used as a draught breed by small and marginal farmers. It produces 300-500 kg milk per lactation.

Mewati Cattle

This breed is mainly found in and around the Mathura district of Uttar Pradesh. Mewati cattle are heavy in built and used for ploughing, carting and drawing water from deep wells. The average milk production of this breed is around 958 kg per lactation.

Ponwar Cattle

Ponwar is a draught type cattle breed and mainly concentrated in Pilibhit district of Uttar Pradesh. The animals have aggressive temperament and produce approximately 463 kg milk per lactation (Gaur *et al.*, 2004).

Gangatiri Cattle

'Gangatiri' literally means 'on the banks of the river Ganga.' The habitat of these animals is along the Ganga River in eastern Uttar Pradesh. These are being used for both milk and draught purpose. The milk production varies from 900-1200 kg per lactation.

Hariana Cattle

The Hariana cattle are a dual-purpose breed and found not only in Haryana but also in Uttar Pradesh and Rajasthan. Hariana cows are good milk producers while the bulls possess good drafting power. This breed has been used for up-gradation of local cattle of the northern plains and produces 700-1745 kg milk per lactation.

Badri Cattle

The Badri cattle also known as Red hill or 'Pahadi' are mainly distributed in Almora and Pauri Garhwal districts of Uttarakhand. These are small sized animals

well adapted to the hill region. It is used both for draught and milk (average 632 kg per lactation) purpose, but production is low (Banga *et al.*, 2005).

Jamunapari Goat

The Chakarnagar region of Etawah district in Uttar Pradesh is a native breeding tract of this goat breed. It is also known as 'Pari' in its native tract due to its majestic appearance. It is large sized breed and famous for its milk production potential. The latest recorded least square mean of lactation milk yield in 140 days was found to be 109.68 litres (Annual Report CIRG – 2018-19).

Barbari Goat

It is dual purpose goat breed raised for both meat and milk production. The animals of this breed are found in Agra, Aligarh, Kanpur regions of Uttar Pradesh. The milk potential of this breed is at par with other Indian dairy goat breeds. The latest total lactation milk yield was found to be 91.34 litres (Annual Report CIRG – 2018-19).

Rohilkhandi Goat

Rohilkhandi goat is found in the Rohilkhandi region (Bareilly, Pilibhit and Shahjahanpur districts) of Uttar Pradesh. The animals of this breed are mainly black in colour and reared for both milk and meat purpose.

Chaugarkha Goat

It is also called as Kumaoni goat, is distributed in the Almora, Pithoragarh, Nainital, Champawat and Bageshwar districts of Uttarakhand state. It is mainly reared for mutton production.

Bundelkhandi Goat

It is originated in Bundelkhand region of U.P. and M.P. It is a medium sized goat, mainly used for meat purpose. It is distributed in Jhansi, Banda, Chitrakoot, Mahoba, Hamirpur, Lalitpur and Jalaun districts of U.P. and Sagar, Panna, Damoh, Tikamgarh, Chhatarpur, Datia district of M.P. These animals are black in colour, well adapted and able to cover long distances while grazing.

Jalauni Sheep

This sheep breed is found in the Bundelkhand region, mostly prevalent in Jalaun, Jhansi and Lalitpur districts of Uttar Pradesh. Jalauni sheep are small to medium in size with white coat colour. These animals are maintained for mutton and wool; however, the wool is coarse in quality.

Muzzafarnagri Sheep

This breed is mostly found in western Uttar Pradesh (Saharanpur, Muzaffarnagar, Meerut, Bulandshahar

and Bijnor) and adjoining areas of Uttarakhand. Muzzafarnagri sheep are large in size known for their fast body growth and high feed efficiency. They are dual purpose, used for both coarse wool and mutton.

Ghurrah Pig

This breed is found in the Bareilly division and adjoining areas of Lucknow division of Uttar Pradesh. The animals of this breed are black in colour, medium sized and reared for pork production.

Uttara Chicken

Uttara breed of chicken is found in Kumaon region of Uttarakhand and reared under backyard farming system. It has a black plumage, feathered shank and produces light brown-coloured eggs.

Status of Phenotypic Characterization

Phenotypic characterization of animal genetic resources enables their categorization for efficient formulation and implementation of management and conservation plans. In line with the Global Plan of Action for Animal Genetic Resources, (FAO, 2007) for management of livestock biodiversity, all the registered breeds of Uttar Pradesh have been well characterized. Morphometric measurements, production, reproduction estimates, management practices etc. are recorded for the animals under survey. Phenotypic or morphological characterization is one of the many criteria required for registration of a breed. A standard procedure for survey and characterization for each species has been defined by ICAR-NBAGR. Recently, Singh (2019), estimated and reported 0.91 and 3.5 population (m) per breed for world and India, respectively. This showed a huge potential to explore new breeds (Singh PK, 2019). Therefore, speedy survey and characterization of all the livestock breeds is need of hour for their conservation and exploitation of unique quality and characters for human welfare.

Status of Genetic Characterization

Much the same as phenotypic evaluation, genetic assessment too provides information of the uniqueness and diversity among animals that can be utilized for their effective conservation and improvement. The advances in technology have led to availability of several state of the art techniques for genetic appraisal. However, neutral or microsatellite markers have been most widely used for genetic evaluation of farm animals. A standard set of microsatellite markers for each species of interest has been established by the International Society for Animal Genetics (ISAG) in collaboration with FAO (DAD-IS-MoDAD; <http://dad.fao.org/dad-is/data/molecula/index.html.MoDAD>). This allows reasonable comparison of parallel or

overlapping studies and helps combine results in meta-analyses. Further recommendations include a minimum sample set of 25 animals per breed (mainly blood samples, hair or tissues). In Uttar Pradesh and Uttarakhand, except for Rohilkhandi and Pantja goats, all registered breeds have been characterized using microsatellite markers. Whereas in case of Uttarakhand, Badri cattle and Uttara chicken have been genetically characterized using microsatellite markers (Phangchopi *et al.*, 2014). A study on spatial genetic diversity of Indian buffaloes revealed sub-structuring within the Uttar Pradesh buffalo population (Vijh *et al.*, 2018). Besides neutral markers, mitochondrial and functional markers have also been used for evaluating the livestock breeds. The phylogeny of cattle, goat (Barbari and Jamunapari only) and sheep has been determined using mitochondrial markers (Sharma *et al.*, 2015, Arora *et al.*, 2013, Diwedi *et al.*, 2020). A number of previous studies have also reported functional diversity in various genes across these breeds (Rout *et al.*, 2010, Arora *et al.*, 2011, Shrivastava *et al.*, 2015). Along with the genetic characterization, deciphering the livestock genome for identification of genes or biomolecules responsible for unique traits of these indigenous breeds would provide an opportunity for their genetic improvement and conservation.

Unique Features of ANGR

It is widely claimed that the indigenous breeds are hardy, disease resistant and productive even at bare minimum level of sustenance. The animal genetic resources of Uttar Pradesh are well adapted to the subtropical Gangetic plains. The Bhadawari buffalo is acclaimed for high fat content in milk (6-13%). However, indiscriminate interbreeding with Murrah has led to dilution of this breed (Vijh *et al.*, 2018, Pundir *et al.*, 1996). Jamunapari breed of goat is known as majestic breed and famous for milk production while Barbari is one of the best dual-purpose goat breeds. Ponwar, Kherigarh and Kenkatha are good draught breeds while Gangatiri and Mewati both are used for milk and draught purpose. Muzzafarnagri is one of the heaviest sheep breeds of India (Yadav and Arora, 2014). Additionally, Badri cow and Uttara fowl of Uttarakhand is hardy in nature, believed to be resistant to various diseases and withstands the harsh climate of the habitat (Banga *et al.*, 2005, Phangchopi *et al.*, 2014).

Lesser-Known Livestock and Poultry Genetic Resources

Recent efforts made by ICAR-NBAGR to identify lesser known, uniform livestock populations for characterization, documentation and inventorization have been worthwhile. Among the several populations identified, Bundelkhandi goats, have been studied

extensively and may be registered in the near future. Other populations namely Jaunpuri goat (eastern Uttar Pradesh), Hansa goat (Faizabad), Kandhan goat (Jalaun), Bathisi goat (Aligarh), Karoli and Nagfani goat (Dhaulpur), Gangai sheep (Gang Fatehpuri) and cattle found in Awadh region, need to be characterized. This suggests that like Uttarakhand, Uttar Pradesh also has no dearth of livestock diversity. However, there is need to characterize this diversity as very few animal breeds have been registered. Some preliminary information has been collated in Uttarakhand on Tarai buffalo (Arora *et al.*, 2003), Chaugarkha, Kumauni and Garhwali goat populations (Kumar *et al.*, 2020, Singh *et al.*, 2019), as well as Hill cattle of Pithoragarh (Pundir *et al.*, 2012). These populations are promising candidates for further characterization and registration. Extensive efforts are still required to cover the entire non-descript livestock populations of both states. Future endeavors need to determine whether the newly found populations are unique and deserve registration. Once registered, the breeds may find place in the state animal husbandry policies for their improvement and conservation.

Conservation of Animal Genetic Resources of Uttar Pradesh and Uttarakhand

The ICAR-National Bureau of Animal Genetic Resources, Karnal has been maintaining National GeneBank for conservation of livestock and poultry genetic resources. Presently, a total of 129174 semen doses, belonging to 44 animal breeds have been maintained by National GeneBank (<http://www.nbagr.res.in/GnBnk.html>). Semen doses of Gangatiri, Kherigarh and Ponwar cattle, and Bhadawari breed of buffalo from Uttar Pradesh have been conserved in the GeneBank. Thus, there is need for conserving other livestock breeds also because the mechanization on agriculture farm has brought draught and dual-purpose breeds in danger. Moreover, indiscriminate breeding with high producing animal could again dilute the purity of low producing pure animal breeds.

Future Prospects

Livestock will continue to play a vital role in the economy of rural India. Climate change and demand for livestock products may considerably affect the livestock sector. It is under such circumstances that we need to be informed of the genetic potential and unique traits of our livestock breeds so that animals best suited to the changing environment can be selected, improved and conserved. India is fortunate to have considerable morphological and genetic diversity in the livestock species. Considering the breeding system in USA, we now realize that the gene pool of dairy cows (*Holstein*) has drastically shrunk over the years due to single objective of increasing milk

production (O'Hagan, 2019). Therefore, it becomes all the more urgent to identify, characterize and conserve the local animal genetic resources. A comprehensive knowledge about all the available genetic resources in a locality will enable the policy makers to select the most suitable breeds for upgrading and conservation. This necessitates the characterization and registration of new germplasm identified. As per the international treaties like CBD, WTO, TRIPS, Nagoya Protocol, Interlaken Declaration on Animal Genetic Resources, India is committed for documentation of all genetic resources to ensure benefit-sharing and sustainable use of genetic resources (Convention on Biological Biodiversity, 2019).

Another factor that could help in sustained development of livestock breeds is the formation of Breed Societies. Breed societies will not only help maintain records of a breed but also ensure its purity. Awareness has to be created among the stakeholders, especially the marginal farmers about the significance of our local animals. This can be done by highlighting the indigenous breeds during exhibitions and fairs and giving incentives to farmers for rearing them. The exploitation of Gaushalas or cow shelters for conservation and improvement of cattle breeds is also a practical and achievable alternative (Mandi *et al.*, 2018).

Rapid advances in genetic research further calls for simultaneous evaluation of livestock species utilizing genomics. This would lead to discovery of unique or important genotypes and genetic material essential for scientific valuation of native livestock germplasm. Economically important genotypes can then be identified and used for breed improvement. Elite animals of indigenous breeds from the same locality may be used for up-gradation. This will prevent genetic dilution by indiscriminate use of one or two commercial breeds for improvement. The discovery of important and unique genes and biomolecules will also ensure sustained genetic management of endangered/threatened populations.

As we witness the sixth global mass extinction event (Ceballos *et al.*, 2015), it becomes all the more urgent to initiate conservation efforts for our livestock breeds. There is an immediate need to identify the basic problems which are responsible for the decline in the indigenous germplasm and address them with best possible interventions. Sustainable conservation requires availability of viable markets as well as value chains. Therefore, we advocate a multipronged approach which addresses not only the phenotypic attributes but also genomics in its entirety, for livestock characterization an all-inclusive knowledge of animal genetic resources will assure proficient decisions

regarding their sustainable management, improvement and conservation.

Conflict of Interest

The authors declare that there is no conflict of interest.

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