

Review paper**Indian livestock: Status, characterization and its documentation**

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Livestock sector is an integral part of Indian agricultural system. In this review, present status of population, characterization and documentation of Indian livestock with special emphasis on indigenous has been given.

Key words: Genetic characterization, Phenotypic characterization, Livestock

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INTRODUCTION

Livestock sector plays an important role by supporting the livelihood of the rural population. It contributes to the national economy in general and to agricultural economy in particular. It also provides employment to the people (male & females both) irrespective of their educational status. It is estimated that about 70 million rural households own livestock of one or the other species. About 20.5 million people depend upon livestock for their livelihood. It also provides employment to about 8.8 % of the population in India. Women constitute about 69% of

workforce engaged in livestock sector.

Current population status

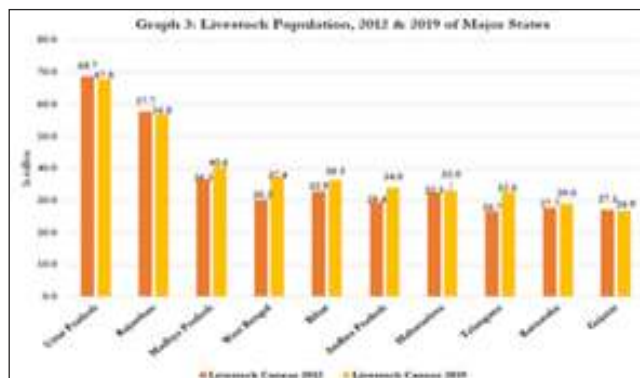
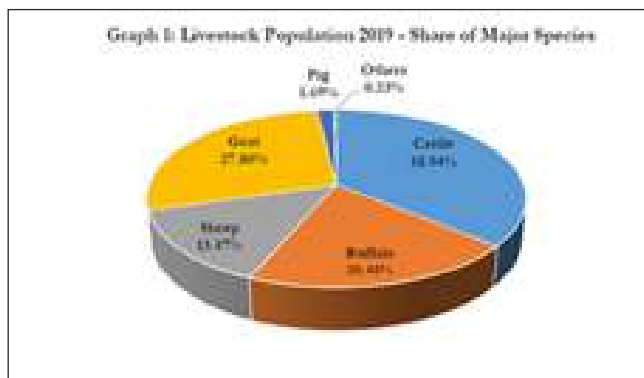
The total Livestock population is 535.78 million in the country showing an increase of 4.6% over Livestock Census 2012 (table 1). Total Bovine population (Cattle, Buffalo, Mithun and Yak) is 302.79 Million in 2019 which shows an increase of 1.0% over the previous census. India ranks first in cattle & buffalo production while in goats and sheep production it ranks 2nd and 3rd respectively. The milk production obtained from the livestock ranks country 1st in the world.

Table 1. Growth of livestock population (in million) as compared to last livestock census.

Category	Population 2012	Population 2019	% growth
Cattle	190.90	192.49	0.83
Buffalo	108.70	109.85	1.06
Sheep	65.07	74.26	14.13
Goat	135.17	148.88	10.14
Pig	10.29	9.06	-12.03
Mithun	0.30	0.38	26.66
Yak	0.08	0.06	-25.00
Horses & Ponics	0.63	0.34	-45.58
Mule	0.20	0.08	-57.09
Donkey	0.32	0.12	-61.23
Camel	0.40	0.25	-37.05
Total Livestock	512.06	535.78	4.63

The share of different livestock species to the total livestock population is 35.94% (cattle), 20.45 (buffalo), 27.80 (goats), 13.87% (sheep), 1.69 (pig) and 0.23 by other livestock species. Madhya Pradesh, West Bengal,

Bihar, Andhra Pradesh, Maharashtra, Telangana and Karnataka showed the increased trend whereas Uttar Pradesh, Rajasthan and Gujarat indicated a marginal decrease from the last census conducted in 2012.



Breed status

A 'breed' is a group of individuals having uniform traits, represent a closed gene pool, mate true to produce the similar offspring with the same set of characters, share a common habitat and is regarded distinct by its breeder. So to identify a breed, study of characters (Characterization) of a population becomes essential. It can be declared as breed if meets the above mentioned criteria. The 'World Watch List for Domestic Animal Diversity' report (3rd ed.) documents more than 6300 breeds of livestock belonging to 30 domesticated species. These breeds were developed following domestication and selection over the years. The current number of breeds is an under estimated figure as a large proportion of indigenous livestock populations of the developing world, are yet to be described. Indian Council of Agricultural Research (ICAR) identified National bureau of Animal Genetic resources (NBAGR) as a nodal agency for registering a population as breed. The breed registration committee headed by the Deputy Director General (Animal Sciences) meets every year to assess the breed applications. The format and the procedure for getting a population registered is available on the institute website (www.nbagr.res.in). So far, it has registered 184 indigenous livestock breeds of the country, which include 43 for cattle, 16 buffalo, 34 goat, 43 sheep, 7 horses & ponies, 9 camel, 8 pig, 2 donkey, 1 yak, 19 chicken, 1 duck and 1 geese.

Characterization of AnGR

Due to lack of comprehensive information on a population many populations remain 'nondescript' or

'traditional'. Characterization is a process to know the various aspects like look, features, dimensions, nature, behavior or any unique trait of an individual /individuals /population. A quality confined to an individual or a group is known as its unique trait. In animal kingdom particularly livestock sector, characterization is carried out at phenotypic level and at genotypic level. Phenotypic characterization is the practice of systematically documenting the observed characteristics, geographical distribution, morphological features, body measurements, production system and utility in its native environment. The area of distribution where the animals produce and reproduce by mating within the same group giving births to same type of animals with similar performance, defines its 'breeding tract'. Phenotypic characterization can be carried out by taking a single visit (pilot survey) to get the preliminary information on a population through self-recording, interaction with livestock keepers and animal husbandry officials. This gives a vague idea about the merits and demerits of the population. The repeated visits can be conducted to generate the detail information in case the population shows positive signs to be a breed. This confirmatory approach validates the information collected during different visits and thus provides a systematic description of a population.

To delineate the native tract, the areas of visit should be finalized in consultation with the officials of state Animal Husbandry or Livestock Development Board of the concerned state. Assuming that breeding tract of a breed is spread over adjoining districts of a state, stratified two stage sampling design can be adopted.

Different zones (stratum) within a district shall be identified. Minimum 4 strata may be identified in a district. Five villages per stratum and 20 household per village may be identified for sampling. The manpower consisting of one enumerator per stratum and four enumerators, one for each village may carry out the survey work. The questionnaire / data sheet (designed by NBAGR for different species) may be used for recording the data. To draw a logical conclusion amount of data recorded from each species vary: Cattle, buffalo, sheep, goat, pig and Chicken (3000 each); Horse, donkey and Camel (1200 each).

Type of data collected for characterization: The type of data collected for characterizing a breed varies from species to species. However, some information is common for all species e.g. areas of animal distribution (breeding tract), climate and topography of its habitat, name and origin of breed, community rearing the breed and its socio-economic status, Name of farmer, its village/taluk/district, his socio-economic status, land holdings etc., population status of breed, type of management including disease prevalence and its management, housing, feeding, breeding practices etc. The production and reproduction data include information on utility of animal, type and yield of product, age at maturity, age at first calving/kidding, litter size, rate of mortality. Physical characters include the qualitative and quantitative traits and biometric observations. Data on physical qualitative traits include coat color, head shape, shape and size of ears, horns, colour of skin, horns, hooves, shape and size of udder and teats, tail switch. In case of poultry, colour and type of plumage, shank, earlobe, beak and comb is also recorded. The biometric data include recording of measurements of height, length, chest girth, paunch girth, face length, ear length, horn length, tail length and body weights of different sex and age group animals. The performance of animals is generally recorded in terms of growth, production, reproduction, draft ability, load carrying capacity (in case of donkeys and mules). The photographs exhibiting the representative animals, variability, management practices must be taken during the survey. Further, any other information which farmer feels important to share, may also be recorded. Any Indian Traditional Knowledge (ITK) practiced by farmer for up keeping the animals are recorded.

Genetic Characterization

Genetic characterization is carried out to know the

diversity within and between populations. Livestock populations have evolved unique adaptation to their agricultural production system and agro-ecological environments. Their genetic diversity has provided the material for the successful breed improvement programs of the developed world in the 19th and 20th century. However, livestock diversity is shrinking rapidly. With the exception of the wild boar (the ancestor of the domestic pig) and wild red jungle fowl (the ancestor of the domestic chicken), the putative wild ancestors of our major livestock species, the reservoir of genetic diversity, are now either extinct or low in numbers and threatened by extinction. Among the domesticated populations, it is estimated that 1 to 2 breeds are lost every week (Schearf, B. 2003). However, the impact of these losses on the global or the local diversity remains undocumented. While it is already too late for many breeds in Europe, the situation is also particularly worrying in the developing world where rapid changes in production systems are leading to the replacement of breeds or at best crossbreeding. Therefore, there is an urgent need to document the diversity of our livestock genetic resources and to design strategies for their sustainable conservation (Hanotte and Jianlin, 2005). Here genetic characterization of the population becomes important where we can study the genetic diversity and establish the genetic lineages. Genotypic data may be generated on minimum fifty animals per breed / population, but, the number of molecular markers may vary from 25 to hundreds. Increase in number of markers will enhance the accuracy of data.

Molecular markers used for genetic characterization

Protein polymorphisms were the first molecular markers used in livestock. A large number of studies, particularly during the 1970's, have documented the characterization of blood group and allozyme systems of livestock (Baker *et al.* 1980). However, the low level of protein polymorphism restricted its applicability in diversity studies. With the development of Polymerase Chain Reaction (PCR) and sequencing technologies, DNA-based polymorphisms are now the markers of choice. They include *D-loop* and *cytochrome B*, *mitochondrial DNA* (mtDNA) sequences (maternal inheritance), *Y* chromosome specific single nucleotide polymorphism (SNP) and microsatellites (paternal inheritance), autosomal microsatellite (bi-parental inheritance) (Avisé, 1994), *Y* chromosomes specific markers (Petit *et al.*, 2002). Polymorphic *Y*

microsatellite markers are currently available for cattle, yak and to some extent small ruminants. On the other hand autosomal microsatellites have now been isolated in large numbers from most livestock species and recommended FAO/ISAG lists of autosomal microsatellite markers for genetic characterization studies are publicly available (Hanotte *et al.* 2000). While using the genetic markers it is assumed that the polymorphisms observed are neutral and they are good predictor of the overall genomic diversity of a population, in other words, that variation in allele frequencies between populations will reflect the distribution of genetic diversity within and amongst populations.

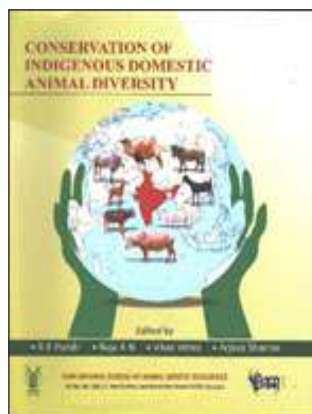
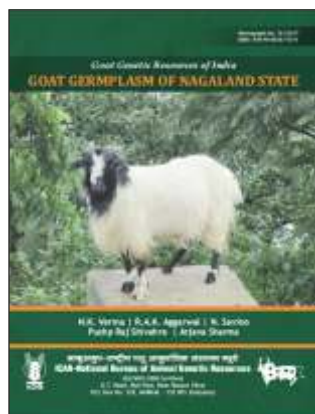
Autosomal microsatellite loci are commonly used for population diversity estimations, differentiation of populations, calculation of genetic distances, genetic relationships and population genetic admixture estimation. Microsatellite loci are also highly sensitive to genetic bottlenecks and are commonly used for inbreeding estimation. MtDNA sequences are the markers for domestication studies as the segregation of a mitochondrial DNA lineage within a livestock population will only have occurred through the domestication of a wild female or through the incorporation of a female into the domestic stock. Last but not least the study of a diagnostic *Y* chromosome polymorphism is an easy and rapid way to detect and to quantify male-mediated admixture. Application of molecular markers in genetic characterization of livestock has only revealed that several ancestral species, subspecies or maternal lineages have contributed to today's genetic pool of our major livestock species (Xuebin, Q. 2004, Bruford, W. *et al.* 2003, Beja-Pereira, A. 2004).

Genetic characterization may provide new information to guide and prioritize conservation decisions for livestock. All the remaining wild ancestral populations, most of them are now endangered, needs effective protection. They are the only remaining sources of putative alleles of economic values that might have been lost during domestication events. It is important to ensure that the breeds selected for conservation include populations with large genetic diversity. Importantly, knowledge of both the global diversity of the breeds and admixture events will be needed in order to be able to

make sound priority decisions. The mean number of alleles (MNA) and observed (*Ho*) and expected (*He*) heterozygosity are the most commonly calculated population genetic parameters for assessing within breed diversity.

Documentation

Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs. Examples are the user guides, white papers, on-line help, quick-reference guides. With the advancement of technology, paper (hard-copy) *documentation* is becoming less common. Even the old documents are being transformed into soft form as a back up or for long shelf life and its easy conversion to hard type. So documents serve as records also. Documentation has become more important in this era of IPR. Due to lack of timely documentation India has to fight a 10-year-long battle at the European Patent Office (EPO) for a patent on a neem (*Azadirachta indica*) derived an anti-fungal product, granted to the US Department of Agriculture and multinational WR Grace in 1995. The turmeric patent was granted in 1995 to two researchers, Soman K. Das and Harihar Kohli of the University of Mississippi Medical Center. After waging a successful campaign against a US patent on the use of turmeric, Dr. Mashelkar has to set up India's first traditional digital knowledge library to defend India's indigenous knowledge against bio-piracy. The Indian government filed 50,000 pages of scientific evidence to the US Patents and Trademarks Office for claiming the basmati rice qualities patent. In livestock sector also documentation on the Indian indigenous breeds is equally important. is yet to be described. There is no concrete published information available on about 50-60 % of the livestock. ICAR-NBAGR was established to describe, conserve and document all the existing breeds/populations of the country. The institute has been successful in its efforts to achieve this to a large extent. We are striving to complete the mission in the coming years. The germplasm characterized by the bureau scientist have also been documented in the form of manuals, breed calendars, breed monographs, bulletins, leaflets, CDs etc. As on date NBAGR has published about 124 such documents and many more are going to be added in the coming days. One can visit the institute web site: www.nbagr.res.in to get the details of these documents.



Breed Registration: Registration is another form of documentation. The institute being a registering authority assess the breed registration application and verify the claim before assigning the accession number to a breed.

The accession number is a notation signifying the name of country, name of species, state (denoted by code/s), name of breed, species and breed (both denoted by c o d e s) i . e .

INDIA_SPECIES_ABCD_BREED_XYEF where **ABCD** = two digit code (AB & CD) each for two different states, **XY** = two digit code for species (06 for goat) and **EFG** = three digit code for breed in the series registered already. For example, the accession number assigned to barbari is **INDIA_GOAT_2017_BARBARI_06002**. Here 20 and 17 are the state codes for Uttar Pradesh and Rajasthan respectively where the breeding tract lies, 06 is the code for goat species and 002 is the code for Barbari breed, the second in the list of registered goat breeds. As mentioned above, 184 livestock breeds have been registered so far,

Recently, all the 184 registered indigenous livestock breeds have been notified in the official Gazette of Govt. of India vide notification F. No. D-4/08/2019-IC-I dated 11 October 2019. The notified breeds of livestock and poultry are to be kept and reared for purposes of animal husbandry, production, breeding, conservation, utilization, consumption and trade and shall be the notified breeds for the whole of India for the above purposes.

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