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BUFFALO GENETIC RESOURCES IN INDIA AND THEIR CONSERVATION

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Abstract

The buffalo plays a very important role in Indian economy as it alone contributes about 56% of total milk production in India. The river buffaloes (Bubalus bubalis) of the Indian sub continent are maintained chiefly for milk production, but all of them are also dual purpose animals, exhibiting good meat characteristics, though their potential for meat still remain unexplored and unexploited. The swamp buffalo is more or less a permanent denizen of marshy lands, where it wallows in mud and feed on coarse marsh grass. The best known breeds are Murrah, Nili-Ravi, Jaffarabadi, Surti, Mehsana, Kundi, Nagpuri and Bhadawari. The germplasm of such well-defined breeds constitute a valuable genetic resource which needs to be conserved on priority basis. The situation is further complicated by the fact that there exists no breed societies or breed registration/ improvement societies to register animals of specific breeds, maintain herd books and ensure the purity of the breeds.

Keywords: *genetic resources, conservation, domestication, germplasm*

1. INTRODUCTION

The buffalo forms the backbone of India's dairy industry and is rightly considered as the 'bearer cheque' of the rural flock considered as India's milking machine (Balain, 1999). Asian countries have been producing over 96 percent of world's total buffalo milk at an annual growth rate of 4.0 percent. India, with 32 million tons, is world's topmost buffalo milk producer accounting for 64 percent of the world's total of 49 million tons. The world's buffalo population has been estimated to be about 164.9 million, and of these more than 56 percent, i.e. 93.8 million, are in India (FAO, 2000). These animals require a relatively low level of inputs in the predominantly mixed farming systems, and are well known for their ability to thrive on low-quality crop residues and green forage (Resali, 2000) under harsh climatic conditions. Furthermore, the

contributions of milk, meat, manure and draft power of the buffalo to the overall national economy have been overwhelming (Shrestha and Shrestha, 1998). This large population of buffaloes contributes more than 50% of total milk produced by Indian livestock. So needless to add, buffalo is one of the most important livestock in India and its genetic potential for production and reproduction traits has to be improved to cater to the huge demand of our country.

Conservation is the act or process of protection, preservation, management or restoration of wildlife, livestock and natural and cultural resources and management of human use of bio-sphere so that it may yield the greatest sustainable benefit to present generation.

2. Breed types, Origin and Domestication

The Asiatic and European buffaloes belong to the genus *Bubalus*, while the African buffaloes to the genus *Syncerus*. The Asiatic genus, often described as water or river buffalo, consists of two types (river or swamp) distinguishable on the basis of their appearance, behavior, use and habitat. The river buffalo (*Bubalus bubalis*) of the Indian sub continent, Egypt and Mediterranean basin of Europe and maintained chiefly for milk production (Cockrill, 1982) but all of them are also dual purpose animals, exhibiting good meat characteristics, though their potential for meat still remains unexplored and unexploited. The swamp buffalo is more or less a permanent denizen of marshy lands where it wallows in mud and feed on coarse marsh grass. It is mainly found in South East Asia and China and has a very minor or no role in milk production. In these areas the principal contribution of the buffalo has been draft power for crop land preparation, rural transportation, threshing, water lifting and oil extraction from oil seeds (National Academy of Science, 1981).

The African buffaloes, referred to as the wild buffalo or Cape buffalo, include two sub-species; *Syncerus caffer caffer* (the African or red buffalo) and *Syncerus caffer nanus* (the Congo buffalo). The buffaloes never achieved domestication and still are wild or semi wild. The origin of the buffalo and the time of its domestication is lost in antiquity. The name buffalo is derived from the Greek world 'boubalos' used for the cud-chewing ox-like ruminants. The original domesticated stock of buffaloes is believed to have been derived from the Indian wild buffalo, *Bubalus arnee*¸ while the swamp buffalo was probably first domesticated in China some 5000 years ago. River buffalo seems to have originated and domesticated in the Indo-gangtic plains some 5000 years ago or even earlier as evidenced by the findings of engraved seals depicting buffalo bulls along with mangers in belligerent mood and a she buffalo without a manger. This further reveals the existence of different feeding treatment between bulls and cows even at that time, the former perhaps getting a preferential treatment of concentrate feeding in a manger.

3. Buffalo Germplasm of India

India is a vast country. Major parts of the country are located in tropical, sub-tropical and temperate zones. There are agro climatic extremes in respect of soils, rainfall, temperature etc.

The breeds and types of livestock evolved under such widely varying agro-ecological conditions and varying requirements of man, have acquired adaptive characteristics which are reflected in the diversity of animal genetic resources of the country including buffaloes. India has been regarded as an extremely rich gold mine of buffalo germplasm resources as it harbors all the recognized, high producing breeds of this species. Of the estimated 164 million buffaloes in the world and the 159 million in Asia, India alone accounts for 94 million (56% the of the world and 58% of the Asian populations).

Indian buffaloes may be put into following five distinct groups

Group	Breeds/Types
Murrah	Murrah, Nili-Ravi, Kundi
Gujarat	Surti, Mehsana, Jaffarabadi
Uttar Pradesh	Bhadawari, Tarai
Central India	Nagpuri, Pandharpuri, Manda, Kalahandi, Sambalpur
South India	Toda, South Kanara

These breed types constitute only about 40% of the population while the remaining 60% represent an admixture of different breeds and are commonly referred to as Desi or non-descript types. However, the fact remains that the best known breeds are Murrah, Nili-Ravi, Jaffarabadi, Surti, Mehsana, Kundi, Nagpuri and Bhadawari. The germpasm of such-well defined breeds constitutes a valuable genetic resource.

4. Buffalo Genetic Resource in India

Little information is available about the performance of Indian buffaloes; moreover, it mostly restricted on Murrah, Nili-Ravi and Surti and on the basis of data from different breeds, strains of institutional farms and utility *vis-à-vis* production system in their home tracts and under farmers management conditions. The situation is further complicated by the fact that there exist no breed societies or breed registration/improvement societies to register animals of specific breeds, maintain herd books and ensure the purity of the breeds. There is no controlled breeding in the breeding tract of any of the breeds. Rather uncontrolled breeding is the common order under widely prevalent extensive grazing situations throughout the country.

In majority of the cases, the true productive potential of individual breeds in their breeding tracts has not been adequately documented. This has affected the detailed description of the breeds and also their genetic potential. There is thus an urgent need for differentiating the real breed differences by conducting systemic scientific studies. There is an urgent requirement to

uniformly describe all the Indian buffalo breeds by utilizing common breed descriptors, by studying their native environment, management practices, qualitative and quantitative aspects of morphological, physiological and functional traits, blood groups and biochemical polymorphisms, cytogenetic parameters, DNA analyses, utility and demographical and geographical distributions. This will lead to the identification of the types of genes and gene combinations available in different breeds and will also assist in formulating breeding policies and selection of animals for conservation, propagation and improvement programmes.

5. Conservation of Buffalo Genetic Resources

The country's buffalo genetic resources need to be used judiciously. The rich biological diversity of this species is progressively being eroded due to unplanned breeding. Except in few organized farms which maintain small herds of pure breed, there is almost unrestricted interbreeding among different breeds and there is a marked decline in the availability of unique animals conforming to the attributes of defined breeds, particularly in their native breeding tracts. There has been a non-judicious utilization of buffalo genetic resources in the country. The males are only partially utilized in the form of bulls and bullocks. There is always a scarcity of breeding bulls of superior genetic merit. Above all, the high producing milch buffaloes from the breeding tract, representing the best germplams, are taken to metropolitan cities in large numbers for milk production (NDRI, 2006). After completion of lactation, these buffaloes are slaughtered, causing a serious erosion of elite germplasm.

Though the livestock census in India is conducted specie-wise and not breed-wise, it is extremely difficult to determine the exact number of animals of a particular breed. Preliminary surveys conducted by the National Bureau of Animal Genetic Resources in the breeding tracts of various breeds of buffaloes indicate that the buffalo breeds which need urgent attention for conservation due to their vulnerable status are Bhadawari and Toda. Bhadawari buffaloes are famous for the very high content of fat (10-14%) in their milk. But due to their low milk yield (600-1000 liters) these buffaloes have been used for upgrading with Murrah and consequently the number of pure Bhadawari buffaloes is restricted to a few thousands only. If immediate attention is not paid, the combination of genes imparting high fat percent may be lost. Similarly, the population of Toda buffaloes of Nilgiri hills of Tamil Nadu is limited to 10-15 thousand. These animals have been reared traditionally by the Toda tribes due to their suitability in the hilly regions of their home tract and their superior meat production potential. The number of Nili-Ravi buffaloes in its breeding tract in Punjab is also decreasing at a faster rate due to the preference for Murrah or Murrah graded buffaloes. Yet, a large population of this breed is available in neighboring areas of Pakistan.

6. Approach for Conservation

Broadly, there are two means of conservation i.e. *in situ* and *ex situ*. Conserving the live animals that exist in nature is *in situ* conservation. The animals are maintained in their original habitats under native conditions with no interference in their mode of management, feeding and other conditions. The main problem of *in situ* conservation is inbreeding and genetic drift typical of

small populations. The *ex situ* conservation is to be used when the endangered population is dismally low in numbers, as this process has its own innate problems. It may suffer from spread of disease, or neglect during periods of institutional weakness, besides being costly in long term preservations and losing the relatedness of current genotype with environment when one of these is preserved for long time (Singh *et al*., 2004).

7. Conservation Strategies:

Ex-situ conservation

Generally sperm, oocytes, embryos, DNA and embryonic stem cell are conserved. It is possible now to store a wide variety of living cells for long periods of time. The techniques can be used for the conservation of endangered breeds as follows:

Sperms and oocytes: Deep freezing of semen is suitable for most of the species of domestic animals.

Embryos: Cryopreservation of embryos of cows, buffaloes, sheep, goats and horse has successfully been done to produce offspring. This is a better tool for conservation as all the genetic information is stored in one diploid zygote.

Storage of DNA: Cryogenic storage of DNA is another method of preservation of genetic material.

Cloning of somatic cells: Cloning offers the advantage of producing series of exact replica /copy of the concerned animals.

Embryonic stem cells: Embryonic stem cells are derived from culture of inner cell mass of a young blastocyst. These embryonic cells are totipotent and have potential to develop into viable embryos.

In-situ conservation

Explicit efforts to select males from superior dams under farm conditions and making wider use of the selected best bulls and also preserving their semen are necessary. The process has been initiated for some of the breeds by NBAGR.

Data Bank Strategy: Maintenance of a database containing all relevant breeds, population census and ecological data is essential for designing and implementing conservation strategies. Several agencies are engaged in generation and dissemination of data/information on Animal Genetic Resources. A useful body of knowledge has already been generated/gathered at NBAGR and at other locations.

Gene Bank Strategy: Semen from indigenous breeds has been cryopreserved for use in the future. Ideally sufficient doses should be storedat at least at two locations remote from each other. The preserved material should be periodically evaluated and put into use.

DNA Bank Strategy: Genetic material can be preserved in the form of DNA fragments under cryogenic conditions. This has the advantage over storage of live cells as it is economical, occupies less space and there is no spread of diseases. Within and across different countries the storage of DNA has been made feasible.

Somatic Cell Strategy: With the advent of Dolly sheep, somatic cell technology has received a great fillip. In future it may be possible to produce a live animal from stored somatic cells. This possibility is very important since the protocols for collecting somatic cell samples are less demanding and inexpensive than for collection of spermatozoa and embryos.

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