



Review Article

Animal Genetic Resources of India – An Overview

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Abstract

A very few nations of the world are bestowed with huge resources and India is one of them. India is aptly placed in one of the 12 mega-biodiverse countries of the world contributing about 11.6 percent to the world livestock population, accounting for immense contributions from the livestock sector to its GDP (4.1%). The local indigenous livestock having evolved over thousands of years cooperates to the low management inputs exhibiting unique traits of productivity, feed utilization, disease resistance and adaptability. However, the indigenous livestock germplasm is often threatened to be diluted with the approach of cross-breeding and some other complexities of our breeding policy, including frequent shifts and poor resource base. The Indian government and the agencies concerned are steadfast in the process of making a fool proof and perfect breeding policy. These attempts are often associated with efforts for the conservation of different breeds at their native tracts. By establishing breeding units, national research centres and other such initiatives along with various other missions taken up at ground level, the only aim is to better the productivity and conservation of indigenous livestock resources.

Key words: Breeds, Conservation, Germplasm, Livestock, Productivity, Resources

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Introduction

India shares 2 percent of the world's area and about 11.6 percent of the livestock population (Livestock Census, 2012). The total livestock population in India is 512 million animals from various farm animal species excluding the contribution of 729 million from poultry species. On the livestock front, the



contribution of India to the world livestock populations can be fathomed from the figures of 57.83 percent for world's buffaloes, 15.06 percent for cattle, 25.07 percent for small ruminants (7.14% for sheep and 17.93% for goats), 2.18 percent for camel, 1.3 percent for equine, 1.2 percent for pigs and 4.72 percent for chicken and 1.94 percent for ducks as corresponding contributions. On the other hand, within India, the individual contribution to the huge livestock population is depicted in Fig. 1.

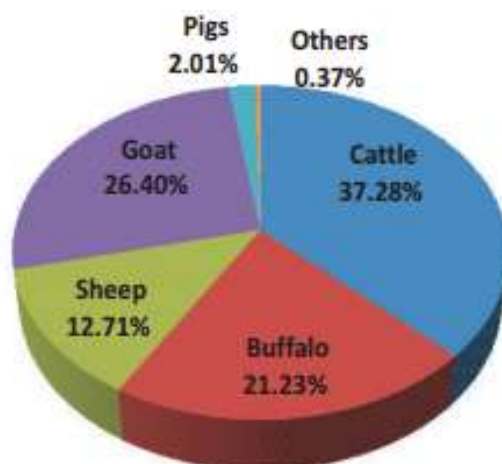


Fig. 1: Per cent contribution of different livestock species in India

On the production front, the livestock sector is considered as the potential answer to the problem of food insecurity in India and the whole world. In India, the milk production has touched 165.4 million tonnes according to the latest reports (2016-17), hiking the per capita availability to 377gms/day, against the world average of 299gms/day. The meat production in India has reached to 7.4 million tonnes during 2016-17 with annual growth of 5.21 percent in recent years. During 2012-13, the overall highest annual growth rate in meat production was observed as 7.87 percent. The egg production in India has reached to 88139 million eggs with per capita per annum availability of 69 eggs in the year 2016-17 from 66 eggs per annum in previous year of 2015-16. The wool production of the country has been recorded as 43.5 million kg (BAHS, 2017). Besides these, the immense contribution of livestock in terms of food and non-food uses like draught, manure, transportation etc. has raised the agricultural output and taken the social welfare a step ahead.

Diverse Animal Genetic Resources

The Indian nation, having diverse climates, is divided into 15 agro-climatic zones each having peculiar characteristics in terms of topography, climate, soil properties, irrigation and others. Each zone has their own specialities to be enjoyed along with the threats being posed because of some inherent nature. For instance, the typical climate of the Himalayan region is conducive to help Pashmina production in Changthangi goats, while the same climate may not be suited for intense livestock produce. On the other

hand, the hot arid and semi-arid regions of Rajasthan are not much conducive for general livestock but the camel species thrive in such regions. The significance of indigenous germplasm is immense in diverse conditions across varied managerial conditions being followed throughout the country. The indigenous livestock resource base is highly adaptable to the local conditions, being aptly capable of thriving under the local conditions. Chanthangi goats produce Pashmina under harsh cold regions of Ladakh that remains snow covered for most of the year. Siri cow having adapted to hilly areas of north eastern states of India while as Nagori breed fit for the harsh conditions of Thar Desert are some of the examples of adaptation and variety of indigenous livestock resources of India. Similar traits may not be found with exotic breeds that may be superior in the production front, but rarely excel under the harsh climatic conditions of the country. On the diversity front, the total number of registered breeds of livestock in India, as per the latest report of National Bureau of Animal Genetic Resources, Karnal, is 183. Recently, 14 new breeds of livestock and poultry are registered (Table 1). Of which, the contribution of various species is like 43- cattle, 15- buffalo, 43- sheep, 34- goat, 7- horse and ponies, 2- donkey, 9- camel, 8- pig, 1- yak, 19- chicken, 1- duck and 1- geese breed. The above figures clearly suggest about the rich biodiversity and population might of India in terms of different livestock species. This may be well judged to its preliminary levels by a thorough study of native Indian breeds and their distinguishing properties that fit them the most in the climatic conditions of the country.

Table 1: Newly Registered Breeds (As on 28.09.2018)

S. No.	Breed	Home Tract
Cattle		
1	Ladakhi	Jammu and Kashmir
2	Konkan kapila	Maharashtra and Goa
Buffalo		
3	Luit (swamp)	Assam and Manipur
4	Bargur	Tamil Nadu
Sheep		
5	Panchali	Gujarat
Goat		
6	Kahmi	Gujarat
7	Rohilkhandi	Uttar Pradesh
8	Assam hill	Assam and Meghalaya
9	Bidri	Karnataka
10	Nandidurga	Karnataka
11	Bakarwali	Jammu and Kashmir
Pig		
12	Ghurrah	Uttar Pradesh
Donkey		
13	Halari	Gujarat
Chicken		
14	Uttara	Uttarakhand

As per the information system on Animal Genetic Resources of India (2018), all the breeds of livestock in India are summarized in the following subheadings.

Cattle Genetic Resources

Cattle species form a main part of livestock in India with major share coming from it. Currently, almost 30 percent of the world's cattle population of approximately 1.4 billion resides in India (Kennedy *et al.*, 2018). The cattle breeds of India have been conventionally divided into following types:

- a. **Milch Breeds** – Sahiwal, Gir, Tharparkar and Red Sindhi (few animals only at organized farms)
- b. **Draft Breeds** – Amritmahal, Bachaur, Bargur, Hallikar, Kangayam, Kenkatha, Kherigarh, Khillar, Malvi, Nagori, Nimari, Ponwar, Punganur, Red Kandhari, Siri, Umblachery, Vechur, Motu, Ghumusari, Binjharपुरi, Khariar, Pulikulam, Kosali, Malnad Gidda, Belahi, Badri
- c. **Dual-purpose Breeds** – Rathi, Haryana, Mewati, Kankrej, Deoni, Ongole, Gaolao, Krishna Valley, Dangi, Gangatiri.

The cattle genetic resource base of India includes Sahiwal breed that stands on the top of indigenous cattle breeds in terms of production aspects. This breed has been used for various breed improvement programmes and development of synthetic crosses in India (Singh *et al.*, 2017). Gir is another important milch breed with significant tolerance to stressful conditions and resistance to various tropical diseases (Sawant *et al.*, 2016). Its uniqueness can be fathomed with the fact that it has been used for breeding programmes in Brazil, Mexican and other foreign countries. Consequently, the *Indicine* breeds like Brahman, Gir and Nellore have been established from these indigenous breeds of India. The present scenario is such that the Indian farmers themselves yearn for germplasm from the Brazilian and Mexican countries. Amritmahal is another indigenous cattle breed known for its power and endurance with draughtability. This breed is aptly the best draught purpose breed of India. Haryana is considered as the best dual purpose breed in India with traits of both milking and draughtability in it. Siri cow is famous for its adaptation and thriving properties in hilly areas of West Bengal and North-Eastern states while as the Nagori breed thrives in most harsh conditions of Rajasthan where other cattle breeds struggle to survive. The Nagori cattle breed is famous for its lightning agility and is used for field work and cart pulling in Rajasthan. The Pulikulam cattle have emerged as one of the recent breeds to be resistant to communicable and parasitic diseases under the local Indian condition, which can be reared in extensive system under all kinds of weather. The manure produced by this breed has been efficiently used as a good input for organic farming (Singh *et al.*, 2012). Kankrej breed of cattle, also famous for its Swai chal gait, represents the heaviest breed in India. Ongole breed of cattle in India is established to possess the natural resistance to two important diseases i.e. Foot and Mouth Disease (FMD) and Mad Cow disease (The Hans India, 2017). On the similar lines, different researchers have established the increased tolerance/resistance of indigenous breeds to various parasitic and infectious diseases

(Chauhan, N. D.). Khillari cattle also can thrive well under famine conditions and are much valued for this quality. The Ladakhi and Konkan Kapila are the two recently registered breeds of cattle, showing different adaptive traits as per the requirement of their native tract (National Bureau of Animal Genetic Resources, Karnal). On one hand the Ladakhi cattle shows survivability to the extremely cold and hypoxic conditions of the cold arid region of Ladakh, whereas on the other hand, the Konkan Kapila breed of Maharashtra and Goa possesses good draft ability in the hot and humid region. Almost all the indigenous breeds have been established to possess traits that are beneficial to thrive under stressful conditions of nutrition, management and climate. Moreover, the indigenous cows provide 'panchgavya', which besides being used as immunomodulator, also finds wide application as biofertilizer, vermicompost and biopesticides in organic farming (Dhama *et al.*, 2005).

Buffalo Genetic Resources

India stands at the top in terms of buffalo population and shares about 56.7 per cent and 97 per cent of the share of total world's and Asian buffalo populations, respectively. The buffalo populations mainly reared in India belong to the riverine type having 50 chromosomes in their genome. The riverine buffalo has been selected as a dairy animal with several well recognized breeds, whereas the swamp buffalo are primarily used for draught purposes (Colli *et al.*, 2018). Even though the Indian buffaloes are less populated as compared to cattle, yet they yield nearly thrice the milk as cows. More than half of the total milk produced (55%) in the country was contributed by the 47.22 million milch buffaloes, whereas the 57.0 million cows contribute only 45% of the total milk yield (Yadav *et al.*, 2017). Buffalo breeds of India have been traditionally divided into following groups:

- a. **Murrah Group:** Murrah, Nili–Ravi, Kundi
- b. **Gujarat Group:** Jaffarabadi, Surti, Mehsana, Banni
- c. **Uttar Pradesh Breeds:** Bhadawari, Tarai
- d. **Central India Group:** Nagpuri, Pandharpuri, Kalahandi, Manda, Jerangi, Sambalpur, Chilika, Marathwadi
- e. **South India Group:** Toda, South Kanara, Bargur

Murrah is virtually the king of milch buffaloes producing high-fat content in its milk. This breed has been used for upgrading the indigenous buffaloes on the national front. Bhadawari and Jafarabadi are two most important milch breeds of Buffalo after Murrah. Bhadawari buffaloes are famous for the very high butter fat content in the milk, as they can efficiently convert coarse feed into butter fat. Chilika Buffalo is famous to thrive in saline conditions, keeping the quality of milk quite significant, in its native location at Odisha. The Banni breed is adaptable in high saline and grassland conditions and produce appreciable quantities of milk even under the extensive production system. The breeds like Mehsana and Pandharpuri possess the

quality of good persistency and high reproducing ability, respectively, among all the registered breeds. The Surti breed is known to produce milk with appreciable amount of fat (8-12 percent) and SNF content. An important and unique trait of immunomodulation has been found in Toda buffalo of Southern India (Niranjan, 2016). The only swamp buffalo breed being registered recently is the Luit buffalo with 48 diploid no. of chromosomes, found in Assam and Manipur. The swamp buffaloes in general are known for their excellent draught power. Another recently registered breed is Bargur, found in Bargur hills of Tamil Nadu (National Bureau of Animal Genetic Resources, Karnal). These animals prove useful in the hilly terrain due to their small size and are reared under the low input extensive system for cara-beef production. But the fact of concern for us is the notification of Bhadawari and Toda breeds, by the nodal agency, as breeds that need conservation at the earliest.

Sheep and Goat Genetic Resources

Small ruminants form an important source of livelihood for poorest of the poor families. They meticulously support the income of these families with their produce in terms of milk, meat and wool. With deep grazing and browsing habits of sheep and goat species, respectively, they are best suited for both hill and grassland areas. The Indian nation is highly bestowed with these genetic resources and around 43 sheep and 34 goat breeds are found throughout India. Traits like prolificacy, meat quality and resistance to parasitic diseases are also unique to Indian sheep and goat breeds and play significant roles in their rearing patterns. The sheep population in India (depicted in Fig. 2) are reared for wool and meat purpose besides other uses in Northern parts, while as they are reared mainly for mutton production in Southern states. The indigenous breeds of sheep are known to be resistant against the endoparasitic diseases, showing lesser egg in faeces and low morbidity and mortality as compared to crossbreds (Bhatia, 2005). Likewise the Garole sheep are found to be naturally resistant to Haemonchosis (Arora, 2004). Garole and Kendrapada sheep breeds, additionally adapted to mangrove ecology of north eastern India, are famous for prolificacy through FecB gene and these are mainly used in introgression programs into the other mutton breeds of India (Sagar *et al.*, 2017). Recently, the National Bureau of Animal Genetic Resources, Karnal, has registered Panchali breed of sheep found in the state of Gujarat, having excellent migration ability. The recent reports of the nodal agency have stated the registration of 6 new breeds of goat in the country, accounting a total of 34 registered breeds. Of these Kahmi, Rohilkhandi, Assam hill, Bidri, Nandidurga and Bakarwali are the recently registered breeds (National Bureau of Animal Genetic Resources, Karnal). Bidri and Nandidurga are the meat type breeds showing common trait of twinning. Assam hill is also a meat type breed known for its high proliferacy.

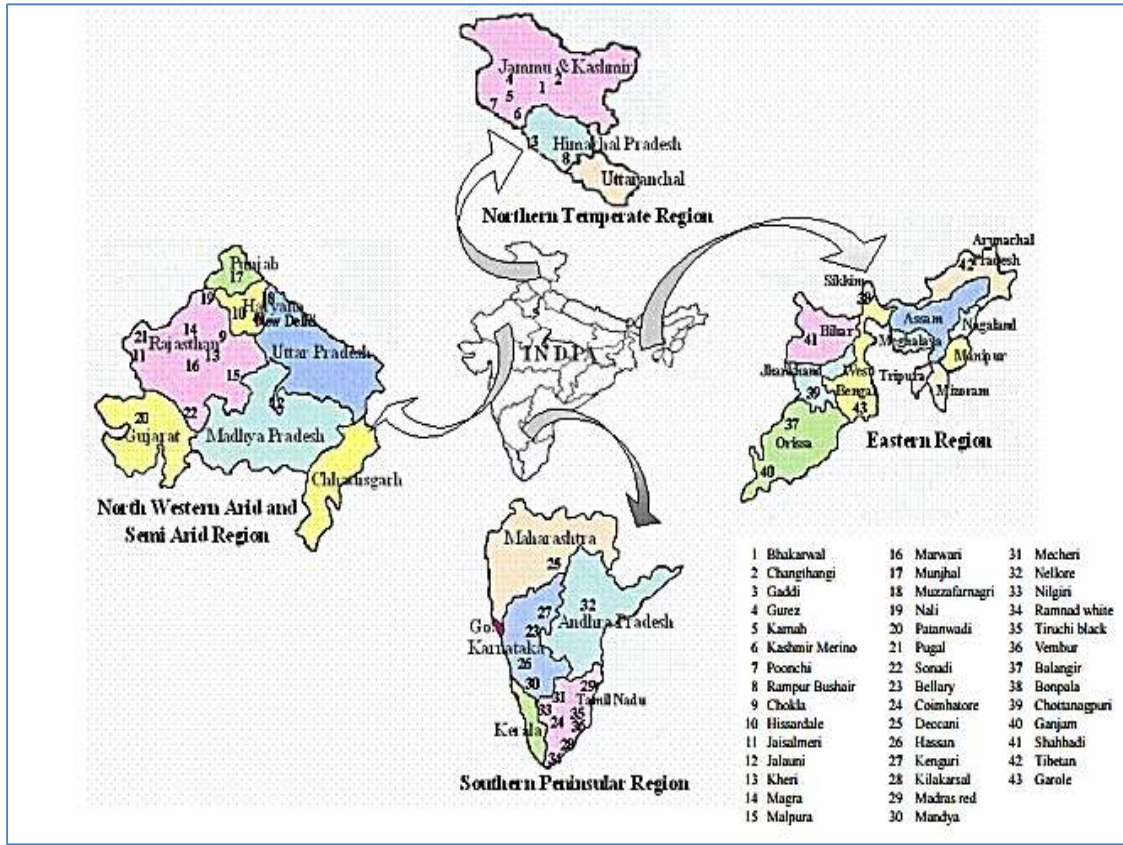


Fig. 2: Distribution of sheep breeds in India

The goats in India are widely distributed throughout the agro-climatic zones of the country. The temperate Himalayan region goats are known for the production of high quality undercoat called ‘Cashmere’ or ‘Pashmina’ and the goats of north-western region are heavy dual purpose breeds. The southern region is famous for its meat-type breeds whereas, the highly prolific breeds are found in the eastern regions (Mandal *et al.*, 2014). The Black Bengal is the only breed known for its high skin quality. Sanem black is known for its early sexual maturity, multiple births and low mortality whereas, Sumi-Ni is reared for its long silky fibres. Barbari, a dual purpose breed, is highly prolific breed witnessing about 60-70% multiple births. Twins and triplets are also frequently observed in Rohilkhandi breed. Beetal, due to its high reproduction efficiency and adaptability, is recognized as an improver breed for medium and small size goats. However, this rich small ruminant genetic diversity is at considerable risk which needs to be prioritized.

Equine Genetic Resources

The population of equines is touching 0.62 million numbers in the country, with 7 registered breeds of horses and ponies and 2 registered breeds of donkey. They are Marwari, Manipuri, Kathiawari, Bhutia, Zanskari, Spiti and recently registered Kachchi-sindhi. Marwari horses are considered as the most potent

symbol of the warrior Kings and these have somehow survived till date, evading all odds of times. On the other hand, Manipuri horses are famous for its utility in polo gaming and are known as Polo ponies (Raj *et al.*, 2011). Spiti and Zanskari horses are found adaptable to hypoxic conditions in hilly areas. Spiti are the sure-footed and tough breed of donkey used for transportation purpose in the mountains, mainly by the army and tribal people of Jammu and Kashmir. Apart from Spiti, Halari is the newly registered breed of donkey in India, found mainly in Gujarat. They are predominantly white colored and can travel long distances during pastoralist migration (National Bureau of Animal Genetic Resources, Karnal). In the present era, the pure breeds of horses are maintained at only a few places mainly associated with the race courses and army. Though the population trends show declining trends for horse species but Mules have been meticulously put to use in hilly areas and for military purposes, due to their agility, endurance and other properties of both horse and donkeys.

Pig Genetic Resources

Pig population in India plummeted to 10.29 million numbers in 2012 recording a decrease of 7.54 percent from the last census. Pigs are considered as living fermenters, converting inedible fodders into highly nutritious and protein rich food. These are highly prolific animals that farrow 10-12 piglets at a time and produce two litters on an average during a year. There are now 8 registered breeds of pigs in India and these are Ghongroo, Niang Megha, Agonda Goan, Tenyi Vo, Nicobari, Doom, Lumsiang and the newly registered Ghurrah breed (National Bureau of Animal Genetic Resources, Karnal). Ghongroo pig is important pork breed mainly reared for pork and manure purpose in Darjeeling and nearby Tarai area of West Bengal. The Tenyi Vo breed pigs are famous for possessing traits of early sexual maturity while as the Doom pigs are considered to be well adapted for transhumanic rearing over long distances. Owing to high prolificacy and ability to sustain in low input system, the Ghungroo pigs are being evaluated for their genetic potential for use in the future breeding programmes. Indigenous pig breeds besides possessing high quality and palatability of pork, show early age at maturity and first farrowing with shorter farrowing interval. They possess immense potential to ensure nutritional and economic security to the weaker sections of the society. Though pig rearing has been traditionally associated with various religious taboos, its rearing patterns are continuously increasing in India, mainly in North-Eastern states.

Poultry Genetic Resources

India is considered to be the first place of domestication for Red Jungle Fowl, the progenitor of present day domestic poultry birds. Indigenous breeds of poultry are famous for their meat qualities, hardiness. They also possess the trait to survive under conditions of the low input system like backyard system, which is very much trending in Indian villages. Aseel and Kaunayen breeds of Andhra Pradesh and Manipur are

famous to possess inherent fighting quality. The lower fat content in the meat of the native breeds makes them have lower caloric value than the commercial breeds of chicken (Valavan *et al.*, 2016). The black meat of Kadaknath is famous for its taste and medicinal value, on account of which it is being used by the locals for the treatment of certain chronic diseases of humans. Its meat and egg possess low cholesterol, high protein and iron content. The naked neck breed, due to its better adaptability to the arid and semi-arid regions of the country, is popular among the locals. Among the indigenous breeds, the only breed with feathered shank is the newly registered Uttara breed found in the Kumaon region of Uttarakhand (National Bureau of Animal Genetic Resources, Karnal). Besides providing immense nutrition through eggs and meat, the native breeds provide various non-food uses for humans. Their hardy and highly adaptable behaviour makes them an important tool for social welfare.

Geese Genetic Resources

Kashmir Anz is the only breed of geese being registered by the National Bureau of Animal Genetic resources, Karnal. These cinnamon or white colored birds are reared for meat, eggs, feathers, or as a hobby in areas located around the water bodies. Kashmir Anz geese are hardy, disease resistant and good foragers, requiring minimum inputs for rearing and management.

Camel Genetic Resources

With 0.4 million number of camels in India, there are 9 well-established breeds of Camel in India and these are Bikaneri, Jaisalmeri, Kharai, Mewari, Malvi, Jalori, Kutchi, Mewati and Marwari. Two types of camel are present in India i.e. single-humped (Dromedarian) and double humped (Bactrian) camel. Aptly known as the ship of the desert, they prove very helpful in the sandy and marshy areas of the nation. Properties like sure-footedness on the sand with high temperament and thriving capacities without much water needs, make them very helpful in these conditions not only to the farmers but also to the military. Bikaneri camels are multipurpose camels, which are used for load carrying and pulling capacity while they are considered as best for racing abilities. Kharai (Sindhi) camels possess a significant trait of surviving in marshy and saline areas of Kutch region of Gujarat and they have the ability to swim. The Jaisalmeri camel is well known for its riding and racing potential, whereas, the Mewari breed is used to carry heavy loads across the hills (Mehta, 2015). The two-humped camel is found in Ladakh region of Jammu and Kashmir where it resides in extreme cold temperatures. However, their population is showing a declining trend by 22.55 percent from 2007-2012, which is a cause of concern for the species diversity and needs to be curtailed.

Yak Genetic Resources

Yak is mainly found in the states of Jammu and Kashmir, Himachal Pradesh and Arunachal Pradesh, with a population of about 0.07 million. Arunachali is the only registered breed of yak. Though the numbers are

less, yaks remain as efficient resources of fur, skin, meat, milk and other products like dung used as fuel by the farmers living at high altitudes. These animals are morphologically and physiologically adapted to live in cold and hypoxic conditions and are mostly found in high altitude regions of Ladakh in Jammu and Kashmir.

Besides these, there are several other species of livestock found in India, including Bison and Mithun, which have religious and economic importance for people at various locations. Mithun, referred to as 'Mountain cattle' or 'Ceremonial ox', are reared in the semi-wild condition in the northeast region of the country for its tender meat and high nutritional value milk. The skin of this animal produces high quality leather, which stands superior to the leather produced by the cattle. With none of the breed registered yet, mithun occupies a population of 0.29 million in the country.

Futuristic View: Concerns and Strategies

Indigenous animal genetic resources are a blessing in itself. It is a pool of genetic resources that have evolved over years of relentless efforts through evolution, adaptability and domestication. The conservation of these important animal genetic resources and their proper documentation is a challenging task that needs to be taken on priority basis. These programmes of conservation need to be aimed at appreciable benefits both in the short and the long-run. These should be based on National survey programmes followed by in-situ or ex-situ strategies of conservation. Moreover, the crossbred animals need to be improved by way of *inter-se* mating only with stabilized exotic inheritance levels. Increasing exotic inheritance levels to unnecessarily higher levels yields nothing significant. Extensive introgression of indigenous germplasm with exotic one needs to be stopped by limiting the practice of indiscriminate crossbreeding going on at various levels. The recommendations based on the outcomes of cross-breeding experiment in India need to be implemented with full zeal. The nondescript cattle must be genetically improved by grading up using elite indigenous bulls. Various reproductive techniques such as Multiple Ovulation Embryo Transfer (MOET) technology, embryonic stem cells, somatic cell cloning etc. offer possibilities for faster multiplication of superior germplasm. Further, technologies like sexed semen, embryo cloning may also be helpful in reducing the male population. Some DNA based technologies are being used for selecting the best animals through Marker assisted selection (MAS), which can be helpful in increasing the frequency of desirable alleles of favourable traits. In crossbred cattle, efforts can be made to reintroduce the A2 alleles by using the males carrying desirable allele.

Conclusion

India is bestowed with huge genetic resources of livestock both in terms of population numbers and diversity. Indigenous animal populations are a rich source of many attributes that are really important in

their adaptability to the local conditions demanding high endurance, agility and resilience from them. However, because of this introgression, we might erode out the worthy indigenous germplasm from our gene pool and end up with exotic species that rarely prove productive under the extreme Indian conditions, except in highly intensive production systems. One might manipulate this germplasm for the production and reproduction purposes but nature whips out these with its own mechanism. The authors believe that the exotic inheritance should be limited to certain scientifically efficient proven levels (i.e. 52-62.5% for semi-intensive and 62-75% for intensive production systems). Overall, the livestock biodiversity in India is immense and we must use this blessing efficiently.

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