

Krishna Valley cattle in India: status, characteristics and utility

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Summary

The Krishna Valley breed of cattle is a draught breed able to withstand extremely hot, humid climatic conditions and which has the capacity to undertake heavy work in the black cotton soil in the valleys of the Krishna river in India. Their home tract is restricted to a few *taluks* (divisions within a district) of the northern parts of Karnataka. The distinguishing morphological features of the breed are the presence of a black-coloured muzzle and black shades dispersed over the body with the lower half of the scrotum also being black in colour. The average values for height, body length and chest girth are 116.4±1.2, 128.4±2.0 and 144.7±2.0 cm in cows; and 150.5±0.5, 146.0±3.0 and 191.0±1.0 cm in bullocks, respectively. The cytogenetic investigation revealed the normal characteristics of cattle chromosomes (2n=60). The microsatellite alleles occurred at frequencies of 0.0208 (ILSTS005) to 0.7604 (ETH152) with the polymorphism information content (PIC) values in the range of 0.3856 (ETH152) to 0.7725 (ILSTS034). The breed has a relatively long productive life as the number of calvings can go up to twelve. As the number of animals of this breed remaining is only in the order of a few hundred, conservation measures are to be taken to avoid the extinction of this valuable germplasm.

Resumen

La raza bovina Krishna Valley es una raza de animal de tiro que se enfrenta con

condiciones climáticas extremas de calor y humedad y posee la capacidad de trabajar bien sobre el suelo de algodón negro de los valles del río Krishna en la India. La zona de procedencia se restringe a algunos *taluks* (subdivisión dentro de un distrito) en la zona norte de Karnataka. Los principales rasgos morfológicos de la raza son la presencia de bozal negro y estrías negras sobre el cuerpo con la mitad inferior del escroto negro. La media de los valores de altura, longitud corporal, y circunferencia en las vacas han sido de 116,4±1,2, 128,4±2,0 y 144,7±2,0 cm; y de 150,5±0,5, 146,0±3,0 y 191,0±1,0 cm en machos. La investigación citogenética muestra características normales en los cromosomas bovinos (2n=60). Los alelos de microsatélites están presentes en frecuencias de 0,0208 (ILSTS005) hasta 0,7604 (ETH152) con valores de información contenida de polimorfismo (PIC) entre 0,3856 (ETH152) y 0,7725 (ILSTS034). La raza posee una vida productiva larga ya que el número de partos puede llegar a doce. Teniendo en cuenta que el número total de animales de esta raza es tan solo de unos centenares, las medidas de conservación se hacen necesarias para evitar la extinción de este valioso germoplasma.

Keywords: Krishna Valley cattle, Characters, Conservation, Performance, Karyotype.

Introduction

The Krishna Valley breed of cattle is well known for its draught qualities and is used exclusively in the black cotton soil in the valleys of the river Krishna. It was also reported to be present in adjacent river areas

such as Ghataprabha and Malaprabha in the Karnataka and Maharashtra states in India (Anonymous, 1926). The breed was distributed in the districts of Satara, Sangali and Solapur in the Maharashtra and Belgaum, Bijapur and Raichur districts of Karnataka (Nivsarkar *et al.*, 2000). But a pilot survey conducted recently by Ramesha *et al.* (2001) indicated a shift in the breeding tract of this breed from Maharashtra and Karnataka to northern Karnataka alone. Only a few hundred true to type animals are now found in and around the villages of the Jamkhandi, Mudhol and Athani *taluks* (divisions within a district) of northern Karnataka. With the background described, this paper demonstrates the importance of the breed in the black cotton soil, its characteristics with regard to physical, cytogenetic and molecular markers and its population status with respect to conservation measures required for the breed.

Origin and History

During the last two decades of the nineteenth century, some of the kings of the Southern Mahratta country (which lies in the watershed areas of the rivers Krishna, Ghatapabha and Malaprabha), tried to evolve a powerful bullock for agricultural purposes for use in the sticky black cotton soil (Joshi and Phillips, 1953). According to Singh and Singh (1936), Ongole cattle were undoubtedly the breed, which played the most prominent role in the evolution of Krishna Valley cattle. It was claimed that Gir and possibly Kankrej cattle from Gujarat state, Ongole cattle from Madras Province (now the areas in Andhra Pradesh state) and local cattle having Mysore-type blood were used to evolve the Krishna Valley breed. The king of Sangli, at one time a well-known breeder of Krishna Valley cattle, contributed substantially in making judicious use of all these strains to produce the desired type of animal. Though there was a wide variation in the characteristics, the massive size of the

resulting animals was the chief dominating factor which attracted the attention of the cultivators.

Breeding Tract and Status

Ramesha *et al.* (2001) in their survey reported that the breeding tract of this breed was restricted to a few villages of the Jamkhandi, Mudhol and Athani *taluks* of northern Karnataka. In a recent visit made by the authors during February 2005, less than fifty animals were found in and around the villages of Jamkhandi in Bagalkod district (a part of the breeding tract). This finding is in agreement with Ramesha *et al.* (2001) who found only a few hundred animals in the entire breeding tract. The animals of this type were also scattered scarcely in other *taluks* such as Mudhool, Bilagi, Bagalkod and Badami of Bagalkod districts. Good specimens of Krishna Valley cattle are available in Mudurakhandi, Kallolli and Savalagi villages in Jamkhandi *taluk*.

The marked decline in the number of Krishna Valley cattle marks a critical and alarming situation, which is evidenced by the shrinking size of the breeding tract and confinement of these animals to only a few regions of northern Karnataka. One of the main reasons for this is the lack of availability of breeding Krishna Valley bulls resulting from the preference of farmers for the Khillari breed of cattle which is more attractive and also massive in appearance. Not much effort had been made to preserve the Krishna Valley draught breed. The other possible reason could be the mechanization of agricultural operations in a few areas. Furthermore, most of the farmers had started selling their Krishna Valley animals due to a continuous drought prevailing in the tract. But few doses of semen samples have been preserved in the Semen Bank in Hassarghatta, Bangalore, in the National Dairy Research Institute, in Adegodi (Figure 1), and in Bangalore and Central Semen Collection Centre, in Dharwad in Karnataka state.



Figure 1. Krishna Valley bullock which was used as a bull for collection of semen and subsequently castrated.



Figure 2. Krishna Valley animals maintained in a Goshala (a non-governmental organization).

The herd size of Krishna Valley cattle found in villages ranges from one to three. The Krishna Valley animals are not maintained *in situ* in any government organizations or livestock farms. The Indian Council of Agricultural Research (ICAR) has recently taken steps to conserve the Krishna Valley germplasm through the National Bureau of Animal Genetic Resources in Karnal, Haryana. Interestingly, in one of the Goshalas (non-governmental organizations maintaining different breeds of livestock in India) situated in Bangalore, more than 25 Krishna Valley cattle are maintained and are effectively acting as the real conservation centre (Figure 2). The breeding of the cattle is carried out through artificial insemination with semen of the same breed; but no genetic improvement measures are undertaken for Krishna Valley cattle.

Ecological Settings

The home tract of Krishna Valley cattle is the plateau east of the Western Ghats. The tract

extends over an area lying between latitudes 15°8' and 17°8' N and longitudes 74° and 78° E (Ramesha *et al.*, 2001). The altitude ranges from 1800 to 2500 feet above mean sea level (MSL). The soils of the area fall into three categories *viz.* red soils in the hills, widely distributed and highly fertile black soils and light gray soils.

In general, the climate is dry. The cold and dry season lasts from the middle of October to the middle of February. The summer season extends from February to June. During the months of April and May, it is considerably hotter. The rainy season usually occurs from June to the middle of October. The annual rainfall ranges from 30 to 50 inches.

Land Holding and Agriculture

The land holding capacity of the farmers ranges from two to ten acres and some farmers do not use the land for agriculture. Canal irrigation is employed in most places and some areas are rain fed and make use of



Figure 3. Krishna Valley cow.

bore well irrigation. Among the agricultural crops grown in the area, wheat is the major crop followed by the others such as sorghum, sugarcane, sunflower, cotton, turmeric and maize. Banana plantations can also be found in the breeding tract of Krishna Valley cattle.

Morphological Characters

The morphological characters are quite varied among individuals, as the breed is a mixture of three distinct breed types *viz.*, Gir, Ongole and the local cattle of the Mysore type. However, certain distinct characteristics can be observed among the animals of this breed which distinguish them from other breeds. The coat color in calves is generally greyish white, although a few dark gray-colored calves are also present. The adult animals are also greyish white in color (Figure 3), usually with darker shades on the fore- and hindquarters in males. The cows of Krishna Valley breed are light gray in color, but sometimes brown-coloured and black and white-colored females are also seen. The

face of the breed is narrow. The forehead is wide and concave. The muzzle is always black in color this being one of the distinguishing features of Krishna Valley cattle. The eyes are wider and the eyelids black in colour. The ears are short, erect, horizontal and pointed, but not drooping. The head is surmounted by short, slate-coloured, curved horns usually emerging in an outward direction from the outer angles of the poll and slightly upwards and then inwards with a mild twist. The tip of the horns is generally blunt. The neck is short and thick giving a massive appearance. The dewlap is pendulous and well developed.

The Krishna Valley is a medium-sized animal with a short body having a moderate hump. The hump in bulls and bullocks is large and black in colour. The barrel is large and well developed (Figure 4). The chest is wide with a well-sprung rib cage which is deep and capacious. The sheath is pendulous in males and the lower half of the scrotum is characteristically black in colour. The udder in the female is medium-sized with short teats and fore teats are longer than hind. The



Figure 4. A pair of Krishna Valley bullocks-ploughing the agricultural field.



Figure 5. Krishna Valley male youngstock with typical light grey-coloured coat and short ears.

tail is long, fine and tapering, extending to the hock joint with the switch being black in colour. The legs are short, thick, muscular and powerful. Black-coloured markings can be found in front of the knee joint and a black coloured patch can also be seen near the fetlock and pastern regions (Figure 5). The bullocks are powerfully built for hauling heavy loads of agricultural produce.

In general, the Krishna Valley is quite distinguishable from other breeds of cattle in South India with their typical horn pattern, characteristically black-colored scrotum and muzzle and black patches over the knee and fetlock joints.

Body Measurements

Body measurements were taken from 44 animals in the breeding tract. The mean and standard error of various body measurements of the Krishna Valley calves,

young stock and adult animals are shown in table 1.

The values are in a slightly higher range than those noticed by Ramesha *et al.* (2001) who estimated the height, body length and heart girth in Krishna Valley cattle as 106.96, 113.20 and 136.96 cm in cows and 121.4, 129.4 and 144.8 cm in bulls respectively. Other characteristics of the horn such as spread at mid-point, distance between tips and horn circumference at base varied between cows and bullocks indicating the variation existing in the orientation of the horns. The thickness of the skin (single-fold) was found to be 3.9 ± 0.3 mm in cows and 7.1 mm in bullocks.

Performance Characteristics

Reproduction

Krishna Valley cows have a relatively long productive life as demonstrated by cows

Table 1. Mean \pm S.E. of various body measurements (cm) of Krishna Valley breed of cattle.

Age groups	Height	Body length	Heart girth	Face length	Face width	Ear length	Tail length	Horn			Skin thickness (mm)
								Length	Spread at mid-point	Distance between tips	
Calves (0-6 month)	78.0 \pm 4.5 (6)	78.3 \pm 7.2 (6)	87.5 \pm 7.2 (6)	28.8 \pm 3.1 (6)	12.9 \pm 0.9 (6)	13.4 \pm 0.5 (5)	54.0 \pm 5.3 (6)	-	-	-	2.4 \pm 0.3 (5)
Calves (7-12 month)	102.6 \pm 2.9 (5)	108.0 \pm 4.6 (5)	116 \pm 4.3 (5)	38.4 \pm 1.9 (5)	14.6 \pm 0.5 (5)	15.0 \pm 0.0 (1)	83.5 \pm 2.8 (4)	-	-	-	2.5 \pm 0.2 (3)
Young stock (1½ - 3 year)	104.6 \pm 3.4 (11)	112.8 \pm 2.1 (11)	129.3 \pm 3.4 (11)	40.5 \pm 0.6 (11)	16.1 \pm 0.4 (11)	94.7 \pm 1.6 (9)	16.6 \pm 0.2 (9)	-	-	-	3.5 \pm 0.2 (10)
Cows	116.4 \pm 1.2 (20)	128.4 \pm 2.0 (19)	144.7 \pm 2.0 (19)	44.9 \pm 0.7 (19)	17.2 \pm 0.3 (19)	102.8 \pm 2.5 (18)	17.9 \pm 0.3 (13)	38.8 \pm 1.4 (8)	23.4 \pm 1.5 (8)	20.8 \pm 4.8 (8)	17.4 \pm 0.6 (7)
Bullocks	150.5 \pm 0.5 (2)	146.0 \pm 3.0 (2)	191.0 \pm 1.0 (2)	53.5 \pm 1.5 (2)	22.00 \pm 0.0 (2)	19.0 \pm 0.0 (2)	121.5 \pm 0.5 (2)	35.0 \pm 12.0 (2)	28.0 \pm 4.0 (2)	35.0 \pm 2.1 (2)	22.5 \pm 0.5 (2)

Figures in parentheses are the number of observations.

with more than nine calvings being found in the villages. They were also reported to have had twelve calvings from a single cow during her life time. According to Ramesha *et al.* (2001), there were regular calvers with an inter-calving period of 13 to 14 months.

The age at first estrus was reported to be between three and three and a half years and the age at first calving was from four to four and a half years. The lactation period varied from five to eight months. No twinning was reported in this breed. Other reproductive problems such as dystochia, retained placenta, abortions and stillbirths have not been reported in the breed.

Production

The milk yields of Krishna Valley cows are not particularly high as they are mainly used for their draught qualities, but the average daily milk yield was 3.17 ± 0.53 kg (n=12) as reported by farmers with the minimum yield of 1.5 kg to a maximum of 8 kg.

Utility

The breed is well adapted to suit the extremely hot, humid climate prevailing in the breeding tract and has the distinct quality of pronounced pulling power. As a result it is used for ploughing in black cotton soil, carting and sugarcane hauling. The bullocks are able to perform hard work in black cotton soil for a relatively long period, *i.e.* between 10 am and 5 pm with only a single break. Ramesha *et al.* (2001) reported that a pair of bullocks could carry loads of up to two tonnes over shorter distances and one tonne over longer distances for up to eight to ten hours a day at a speed of 4 km per hour. As the females produce less milk, sometimes they are also used for ploughing and carting. Because of their adaptability and high tolerance for strenuous work, the breed is suitable for profitable use in remote areas where transportation and mechanization facilities are unavailable.

Since these animals have a medium-sized body and short and powerful legs, they are best suited for ploughing inside the vineyards and carting heavy loads of sugarcane in the hard, marshy, black cotton soil during rainy seasons.

Husbandry Practices

Breeding

The majority of the cows of this breed were run with local bulls and a few with Khillari breed bulls. In the breeding tract, only natural service was practiced and there was no supply of frozen semen from the Krishna Valley breed for use in artificial insemination. In addition the local farmers also did not favour using the breed. At present, no Krishna Valley bull is available in the villages for the farmers to service their cows, but artificial insemination with Khillari semen is done through local veterinary dispensaries and hospitals, as per the desire of the farmers.

Feeding

Usually the female calves are allowed to suckle up to two to three months of age, while male calves may suckle for up to five to six months. After two to three months of age, the calves are hand-fed with green fodder and after five months, they are sent for grazing. The animals are sent out around 8 am for grazing and remain in the grazing area until 5 pm in the evening. A few farmers feed their cows with two kilograms of concentrate mixture. The bullocks are well cared for by the farmers. Wheat bran, sugarcane tops, sunflower oil cake, carrot leaves and other agricultural by-products from maize, sorghum and other crops are fed to the animals. Apart from this, the local grasses from the banks of the river belts are the grazing source for these animals. Efforts had been made by the Department of Animal Husbandry towards fodder

development through the supply of NB-21 (Napier x Bajra hybrid).

Other practices

The males are castrated when they attain three years of age, using a locally made wooden castrator, and after one year, they are trained for carting and other work. Temperamentally, the males of Krishna Valley are vicious and difficult to control. Though the Krishna Valley is a draught breed, twice daily milking is carried out by the farmers at 6 to 7 am in the morning and 6 to 7 pm in the evening.

The breed does not have any cultural relationship with the local people, but during the Karunmae Pournima festival, these animals are accorded special ritual attention. There are two other important festivals to note, these being the Ugadhi, Maha

Shivaratri (Babaladhi festival) during February and March and Shiva Jayanthi which takes place in May. The animals are brought to the shandies (seasonal market) and kept for sale. During these festivals, a livestock fair is conducted and good specimens are also awarded prizes. One such pair of Krishna Valley bullocks which claimed the best bullock award for the past three years consecutively is shown in Figure 6. The Krishna Valley breed is hardy and well adapted to the local climatic conditions.

Karyology

Blood samples were collected from a total of 12 animals including five males and seven females and subjected to short-term lymphocyte culture using standard protocol. About 20 complete metaphase plates were



Figure 6. A pair of Krishna Valley bullocks won the best animal award consequently for 3 years in livestock fair (also seen darker shades over the body, legs and lower half of the scrotum and typical horns).

examined from each animal and the diploid chromosome number was found to be 60 ($2n=60$) in the Krishna Valley breed of cattle. All the chromosomes were acrocentric except the X chromosome which was the largest metacentric, confirming the normal characteristics of cattle chromosomes. The metaphase chromosome spread and its karyotype have been presented in figures 7 and 8.

Microsatellite Markers

The molecular characterization was carried out in a sample of 50 unrelated Krishna Valley cattle in the breeding tract using five different microsatellite (ILSTS005, ILSTS054, ETH152, ETH225, and HEL001) markers as suggested by the FAO (1996). The PCR (Polymerase Chain Reaction) amplified products were resolved through a 6% denaturing polyacrylamide gel and sizing was done using the 10 bp DNA ladder

marker. The Krishna Valley cattle revealed an average allele number of 4.4 out of 5 microsatellite loci screened. The number, size and frequency of alleles, polymorphic information content (PIC) and expected heterozygosity of microsatellite loci in Krishna Valley breed of cattle are presented in table 2. Representative gels stained with silver nitrate bearing the microsatellite alleles (bands) are shown in figure 9. These microsatellite alleles occurred at frequencies of 0.0116 (ILSTS054) to 0.7660 (ETH152). The polymorphism information content (PIC) values were in the range of 0.3722 (ETH152) to 0.6954 (ILSTS005). The overall mean for expected heterozygosity was found to be 0.6516.

Conclusion

The Krishna Valley breed is a medium-sized draught breed and performs well exclusively in black cotton soil areas where other breeds

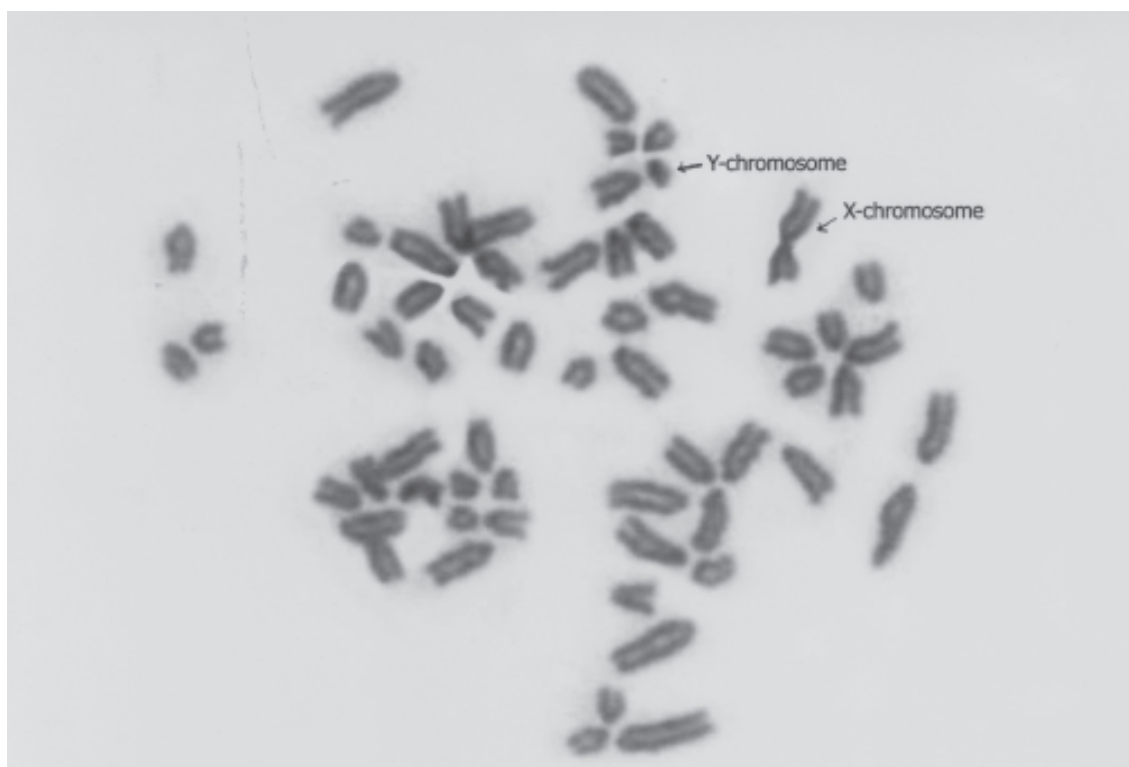


Figure 7. Metaphase chromosome spread of Krishna Valley bull ($2n=60$, XY).

Table 2. Allele number, size & frequency, polymorphic information content (PIC) and heterozygosity of microsatellite loci in Krishna Valley breed.

Sl.no.	Locus	No. of allele	Allele size (bp) and frequency				Polymorphism information content	Expected heterozygosity (Nei's, 1973)
1.	ILSTS005	4	182	186	190	194	0.6954	0.7433
			0.2396	0.1875	0.2917	0.2812		
2.	ILSTS054	6	132	138	140	144	0.6795	0.7182
			0.1977	0.1163	0.0116	0.1744	0.4419	0.0581
3.	ETH152	4	194	200	204	208	0.3722	0.3945
			0.7660	0.0745	0.0957	0.0638		
4.	ETH225	4	146	152	154	160	0.6668	0.7193
			0.2326	0.1163	0.3023	0.3488		
5.	HEL001	4	100	106	108	110	0.6265	0.6827
			0.1778	0.3000	0.4333	0.0889		

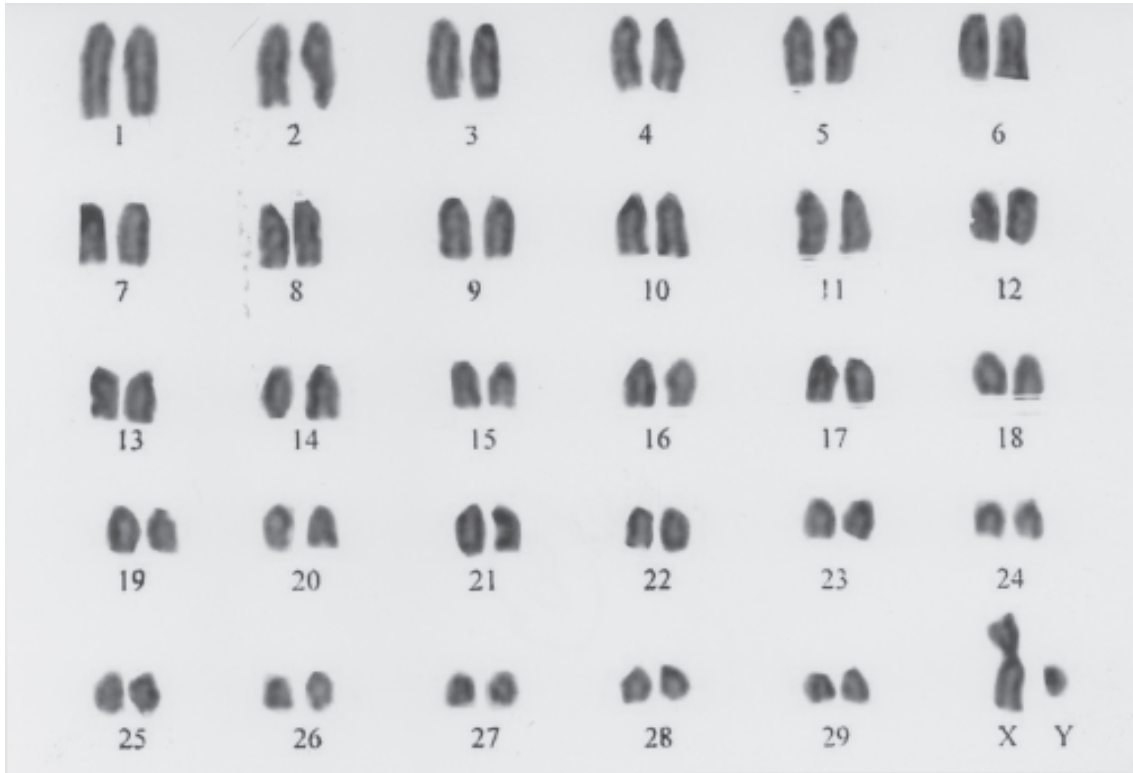


Figure 8. Karyotype of Krishna Valley bull.

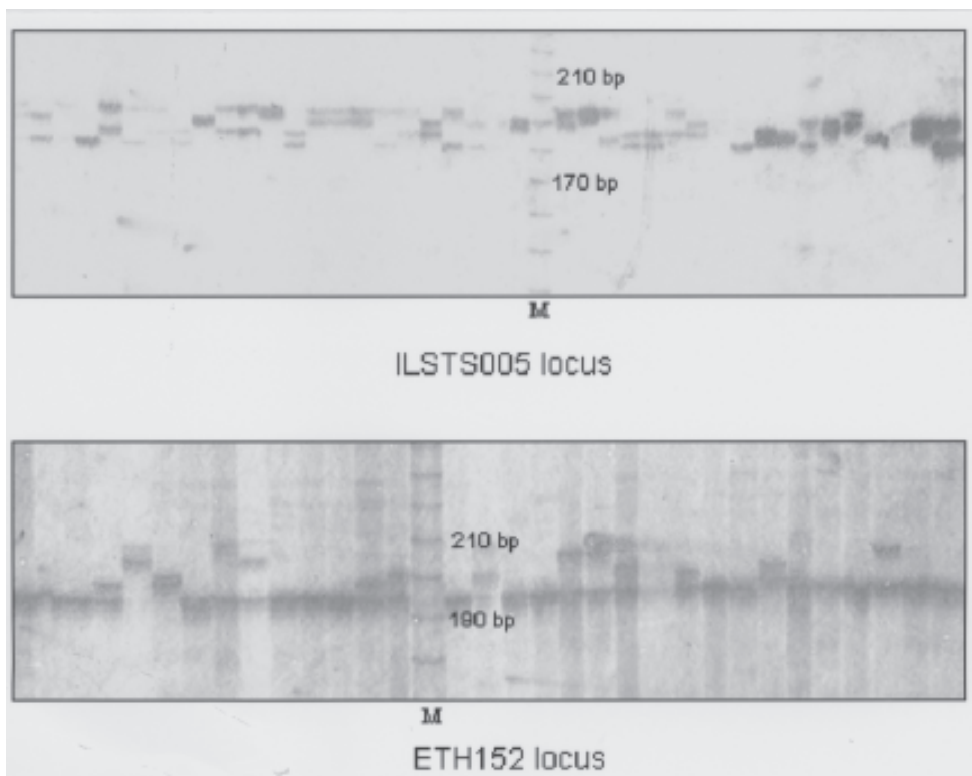


Figure 9. Microsatellite alleles (bp) on silver-stained polyacrylamide gel in Krishna Valley cattle.

do not. The animals appear to have a relatively long productive life of up to 12 calvings and are able to thrive well in hot climatic conditions. However the status of the population is very alarming and it requires immediate attention to develop and implement a conservation strategy. Without such an intervention the breed is likely to become extinct within a few years.

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