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Cytogenetic Investigation of Rare Cattle Breeds of India

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Abstract: A cytogenetic study was performed on rare zebu cattle breeds of India during a routine investigation. The blood samples were collected from the bulls of five cattle breeds viz Punganur, Vechur, Kasaragod, Malnand Gidda and Gangatiri for cytogenetic investigation. The cytogenetic studies revealed 60 (2n) chromosomes in all the five breeds. The karyotype was composed of 29 pairs of autosomes and one pair of sex chromosomes. All the autosomes and Y-chromosome were found to be acrocentric whereas X chromosome was sub-metacentric similar to any other breeds of *Bos indicus* cattle.

Key words: Zebu cattle, autosomes, acrocentric, Y-chromosome, Karyotype, breed.

INTRODUCTION

Indian Desi or native cattle breeds have been declining in numbers and becoming endangered. There were nearly 75 breeds of cattle in India, currently only 39 recognized breed of cattle remain in India (NBAGR). Most of them are reared by tribes or native people. Native breeds of cattle have their set of qualities to cope with the local habitat and weather.

The Punganur dwarf cow, which was originated in Chitoor District, Andhra Pradesh, India, is considered one of the world's smallest breed. The milk of Punganur is with a high fat content and rich in medicinal properties. While cow milk normally has a fat content of 3 to 3.5 per cent, the Punganur breed's milk

contains 8 per cent[1]. It is the world's shortest (miniature) humped cattle, highly drought resistant, and able to survive exclusively on dry fodder. The Punganur is on the verge of extinction as the population is reduced to 733 animals only. The remaining Punganur cattle are being reared mainly on the Government Livestock Farm, Palamaner, Chittoor district, while a small, informal group of private breeders is also working on reviving the species. The breed has been recognised as Punganur by NBAGR (INDIA_CATTLE_0100_PUNGANUR_03022).

Reddy[2] reported a lactation yield of 633.4+21.7 litres over a lactation period of 272.0+8.9 days with an average milk yield of 2.29+0.06 lts. The peak yield was 3.92+ 0.11 litres reached in 33.5+1.6 days and an average dry period of 188.1+11.54 days. Venkateswara Veterinary University, Tirupati has taken the responsibility of conservation of Punganur cattle in Andhra Pradesh. As a part of it live animals are being conserved and propagating under in-situ conservation as well as maintaining frozen semen in ex-situ conservation for future needs. Already, 4000 doses of semen have been stored and 1500 doses were distributed to the farmers maintaining Punganur type of animals in native breeding tract[3]. The average lactation milk yield was 457.5 ± 81 litres with a lactation length of 153 ± 24 days. The average daily milk yield and peak yield were 3.04 ± 0.16 and 3.90 ± 0.17 litres respectively, with an average 5.4 % fat and 9.53 % S.N.F. was also reported[3].

The Vechur Cattle are a rare breed of *Bos indicus* named after the village Vechoor in Kerala. It is the smallest cattle breed in the world according to the Guinness Book of records (6 January 2012) and is valued for the larger amount of milk it produces relative to the amount of feed and fodder it requires. The Vechur cow was popular in Kerala until the 1960s, but became rare when native cattle were crossbred with exotic cattle, *Bos taurus*. The breed averages height and adult weight of cattle are 98.2±1.41 cm in female and 89.0±0.68 cm in male132 kg in female and 178 kg in male respectively, yielding up to 3 litres of milk a day[4]. The cattle are resistant to mastitis, foot and mouth diseases and respiratory infections. The milk is believed to have medicinal qualities and easy digestibility due to smaller fat globule size (www.vechur.org). It is recognized cattle breed of India by NBAGR (INDIA_CATTLE_0100_ PUNGANUR_03022).

Kasaragod Dwarf Cattle are a breed of cattle in Kerala. They originated in the mountain range of Kasaragod district. The cows are known for their excellent milking ability and give mineral rich milk with high feed to milk ratio. It is believed to be second smallest cattle breed and is a little taller than the world's smallest breed of Vechur**.** With an average height of 90 cms, it can survive on kitchen waste and jungle feeds. It requires about 2 kg of feed per day. It's milk yield on an average 1 L/day. The milk is nutritious, rich in alpha-2 casein proteins, which means it is particularly useful for diabetes and hypertension patients. Kasaragod Dwarf has still not been included in the list of India's 37 native cattle breeds that have been documented by the National Bureau for Animal Genetic Resources (NBAGR) Karnal, (Haryana).

Malnand Gidda is a cattle breed of Karnataka. Malnand means a hilly region and Gidda means small or dwarf. The breeding tract of this breed includes Chikmagalur, Dakshin Kannada, Hassan, Kodagu, Shimoga, Uttar Kannada and Udupi districts of Karnataka. This breed of cattle plays a major role in the rural economy of the region by providing milk, manure and draft power with negligible inputs. They are well adapted to the local agro-ecological systems. The population of the breed is about 7-8 lakh in

Karnataka but is showing a declining trend. This breed has been recently included in the list of recognized cattle breeds by NBAGR, Karnal during 2012 (INDIA_CATTLE_0800_MALNADGIDDA_03037). There are various coat colours; black, brown, red and mixture of them[5]. Elite cows give 3-5 kg of milk per day and the average lactation yield is around 220 Kg.

Gangatiri is a dual purpose cattle breed, found in Eastern Uttar Pradesh and Western Bihar along the river Ganga. They are a dual purpose breed yielding 4-6 Kg milk/ day (UP State Diversity Board). The breed is also recognized (INDIA_CATTLE_2003_GANGATIRI_03039) by NBAGR.

MATERIALS AND METHODS

The blood samples were collected in heparinised blood collecting vacutainer tubes from 18 bulls of 5 rare breeds of zebu cattle as tabulated below for routine karyotyping.

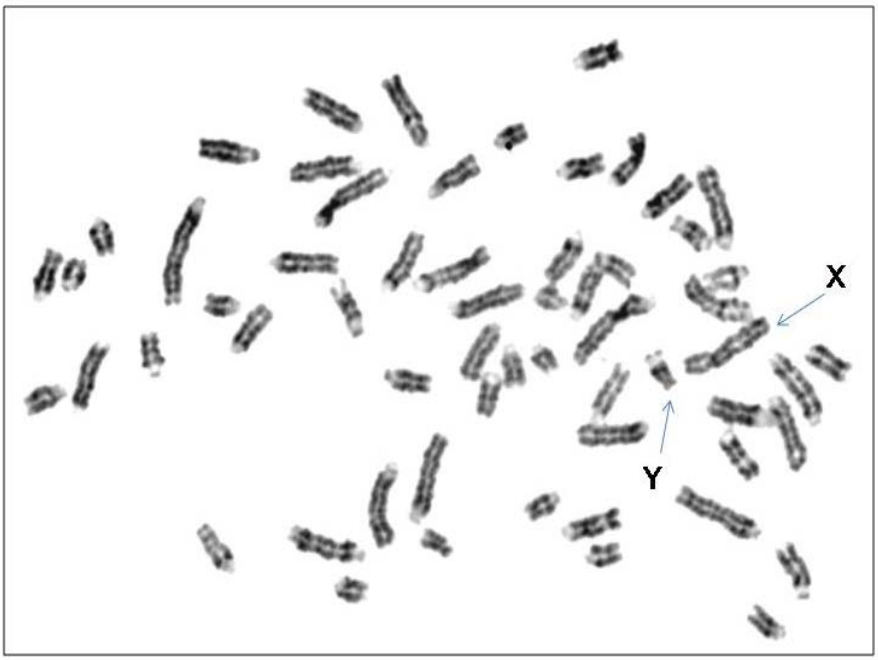
S No.	Breed	No. of samples
1.	Gangatiri	5
2	Panganur	1
3	Vachur	5
4	Kasargod	3
5	Malnad Gidda	4
	Total	18

Chromosomal preparations were performed using standard procedure[6]. G-banded metaphase plates were screened for chromosomal analysis using Olympus microscope attached to image Analyzer system (Cyto Vision).

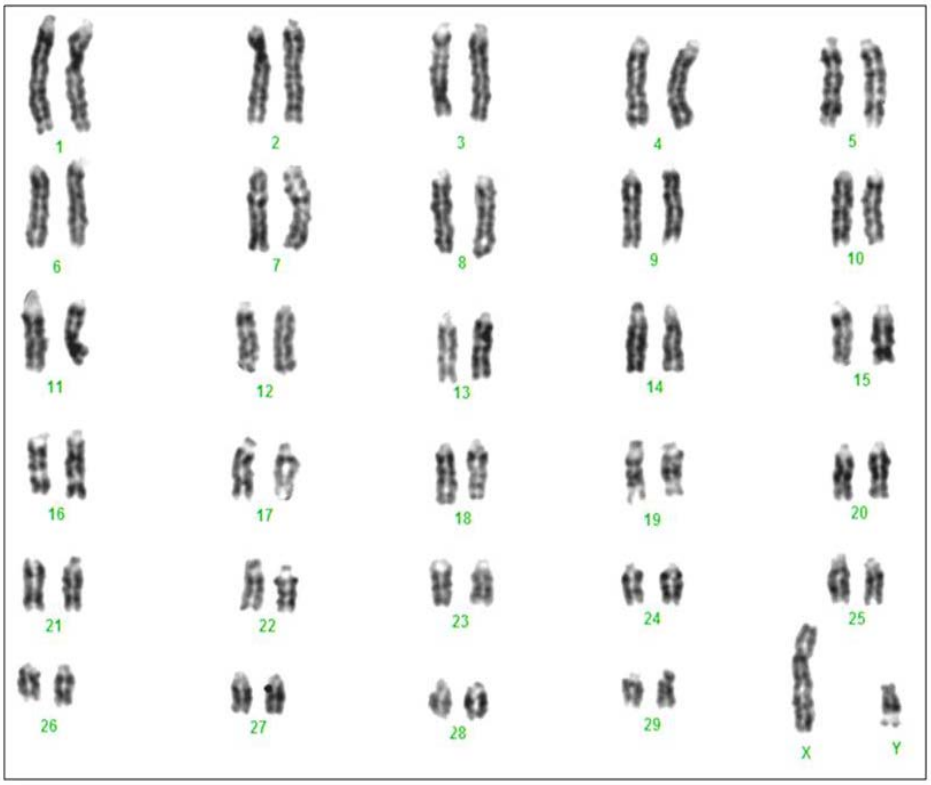
RESULTS AND DISCUSSION

The cattle normally possess 60 (2n) chromosomes. The karyotype composed of 29 pairs of autosomes and one pair of sex chromosomes. All the autosomes are acrocentric and sex chromosomes (XY) are submetacentric in *Bos taurus*, whereas Y chromosome is acrocentric in *Bos indicus*. All the five breeds of cattle included in the present studies exhibited acrocentric Y chromosome as observed in other breeds of *Bos indicus.* Similar to our observation, Girija[7], reported the diploid chromosome number (2n=60) with 29 pairs of autosomes and one pair sex chromosomes in Vechur cattle. All the autosomes and Y chromosome were acrocentric whereas X chromosome was sub-metacentric.

Cytogenetic investigation report[8] in Malnad Gidda (*B.indicus*) exhibited a normal chromosomal complement of 2n=60 (58 autosomes and 2 sex chromosomes). They also reported submetacentric X-chromosome and acrocentric Y-chromosome in Malnad Gidda cattle which is also similar to our observation. Because of paucity of literature on Cytogenetic investigation of other three breeds viz Gangatiri, Panganur and Kasargod, our observations could not be compared. However, the aforementioned breeds of cattle have also exhibited 60 chromosomes (2n) constituting 58 acrocentric autosomes, submetacentric X-and acrocentric Y –chromosome respectively.



G-banded metaphase field. Arrows indicate sub-metacentric X and acrocentric Y-chromosome



Karyotype of the same field

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