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Studies on genetics of body colouration of Black Bengal Goat (*Capra hircus bengalensis*) in some areas of West Bengal

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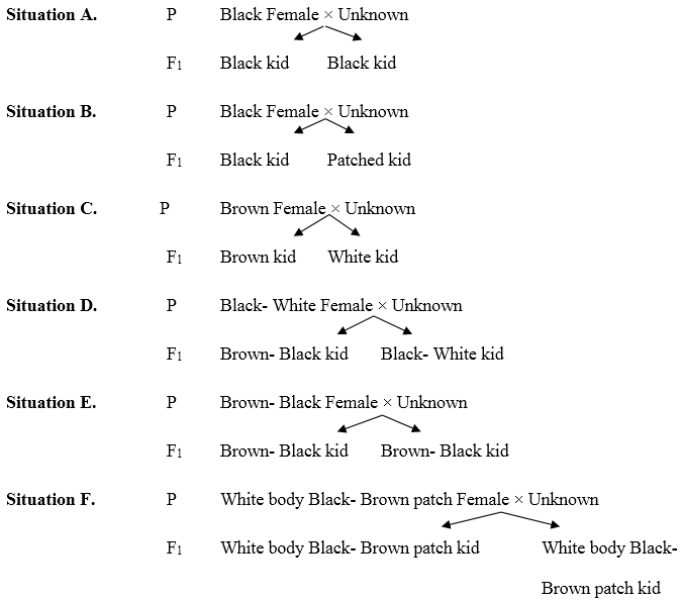
Abstract
Black Bengal (BB) goat is one of the recognized breed among the domestic species in India and serves as integral part of rural India's symbiotic system of crop and livestock production. Variation is a unique feature for every organism which is manifested through morphology. BB goats are known to be famous for their adaptability, prolificacy, delicacy of meat and superior skin quality. It is precious germplasm of West Bengal. But till now enough care has not been taken to study the morphology of body colour in Black Bengal goat. Therefore a preliminary investigation has been done to know the variation in morphology of body colour in Black Bengal goat in some areas of West Bengal. Studies on the morphological variation in body colour in 50 goats both adult and kids have been conducted. The data reveal that black colour and brown colour are more prevalent than the white colour in both the adult and kids.

Keywords: Morphology, Body Colour, Eumelanin and Pheomelanin.

1. Introduction
Black Bengal goat represent a remarkable source in Bengal native animal genetic resources mainly due to its adaptability, prolificacy, delicacy of high-quality low-fat meat and superior skin quality. [1, 2, 8] Various lines of data [2, 7, 10] indicated that the black Bengal goat is a dwarf breed and distributed not only in villages of West Bengal but also in the adjacent part of neighbouring states of West Bengal viz., Bihar, Orissa, Jharkhand and Assam. They are considered as true friends to the rural people and popularly known as "poor man's cow" and are well adapted to all kind of climatic conditions and have relatively low maintenance requirements like capital, housing and facilities. [8, 9]
Cytogenetic studies of breed is also important in animal genetic resource conservation and management. [11] Small marginal landless rural farmers of different district of West Bengal rear goat, which is helpful for restoration and conservation of wild type gene pool of Black Bengal goat of West Bengal. Body colour in animal is known to exhibit a large amount of variability resulting either from genetic polymorphism or phenotypic plasticity. [4] Previously several scientist [3, 5, 11] extended their cytogenetic studies on body colour in different goat breed but till now no research work regarding the cytogenetic studies on body colour in Black Bengal goat in West Bengal has been extended. Therefore, the aim of the present study on the body colour is to conduct a preliminary cytogenetic survey on body colour in the Black Bengal goat in order to onset a cytogenetic screening programme for the breed in West Bengal.

2. Materials and Method
The live domesticated animals were selected on the basis of apparent good health and without any physical deformation. Morphological variation in the body colour and colour patch patterns of 50 Black Bengal goats both adult (16) and kids (34) has been obtained from the rural areas of three villages of Hooghly and Howrah district for our study. Information regarding family history was obtained from the owner of the domesticated animals. Photographs have been taken for the site of investigation of the locality as well as observed morphological variations of traits.

3. Observation& Result
During our investigation 50 individuals breeds (16 mother and kids) have been studied. Information regarding body colour of the father goat is unknown because the people usually sold them to market for their economic value.
In our study the following situations are observed:



Our investigation indicate that in some cases kid's body colour are exactly same to their mother and in other cases kid's body colour is not similar to their mother. But the body colour of

their father is unknown. Therefore as per Mendelian genetics both the mother and father have to be homozygous in first case and in other case mother may be heterozygous while the father may be homozygous or heterozygous.

4. Discussion

Variation is unique feature in every organism which has been manifested through morphology. In Black Bengal goat it is manifested through body colour viz., black, brown and white etc. (Fig: 1). Wide range of body colour and colour patch patterns makes them fascinating as "icing on the cake". The huge variation in body colour in goat can often lead to some confusion. It has been reported [12] that two components (pigments) viz., eumelanin and pheomelanin control body colour in goat. These two pigments generally present or absent in varying combinations and impart body colour. Eumelanin is responsible for black and brown body colour in each goat. On the other hand pheomelanin is responsible for white and cream body colour. Genetic control over body colour in goat is complicated. Final colour is the result of interaction of several different components and their respective genes in different loci. Our investigation (Table -1) reveal that there are eight black mother goat, two white- black patched mother goat and one white body with black- brown patched mother. From our data it is assumed that the black colour in this breed is dominant over all other colour and produces wild type colour in F_1. Brown colour is lighter than black colour and is dominant over white body colour and produces patched colour (Brown- White, Brown-Black) kid in F_1. Our investigation also reveal that the order of dominance for body colour in goat is as follows black colour>brown colour>white colour (Table 1). It has been reported [12] that most of the body colour variation in goat is regulated by agouti and brown locus alleles (genes). Agouti locus alleles can produce black and white body colour. There are multiple genetic mechanism can account for both black and white colour in goat. It has been known that agouti locus allele control both eumelanic and pheomelanic areas. While white alleles in agouti locus control pheomelanic areas and act as dominant. Black allele in agouti locus act as recessive and controls eumelanic areas. On the contray, brown locus allele act to switch eumelanin from black to brown colour and is dominant over other colours. It has been reported that "white spotting" are usually developed due to the lack of pigment cells and is superimposed over the base colour. [12] Genetic variation can be measured within and between the breed population which makes the breed characteristics. [12] Therefore it is assumed that both agouti and brown locus control body colour in Black Bengal goat. Dominancy of allele is breed specific. The interaction of both alleles make the final colour in breed. From our investigation it is assumed that brown locus allele may play a major control over the body colour in black Bengal goat in West Bengal. Earlier Kumari et al. 2013 noted that in nature genetic erosion and degradation occur continuously which rebuild the molecular characters of goat. [6] Previous studies [7, 8, 12] indicated that the persistence of genetic variation is remarkable in Black Bengal goat. For future study in breeding process as well as molecular analysis will help to know the actual inheritance of colour in Black Bengal goat.

Table 1: Parental Inheritance to the kids along with genotypic symbol

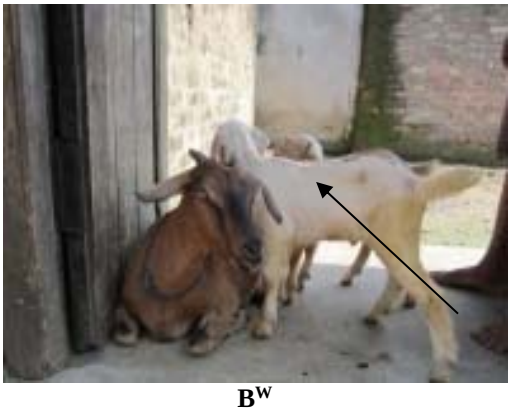
Sr. No.	Phenotype of Mother	Genotypic Symbol	Phenotype of Kids		
1	Black	B^{+}	Black	Black	
2	Black- White	B^{B-W}	Brown-Black	Black-White	
3	White-Black	B^{W-B}	Brown-Black	White-Black	
4	Black	B^{+}	Black	Black	
5	White-Black	B^{W-B}	White-Black	White-Black	
6	Black	B^{+}	Brown-White	Brown-White	
7	Brown	B^{Br}	Brown	White	
8	Brown	B^{Br}	Black-White	Brown-White	
9	Black	B^{+}	Black-White	Brown	
10	Black	B^{+}	Black-White	Black	
11	Black	B^{+}	Black	Black	
12	Black-White	B^{B-W}	Black-White	Black-White	
13	Black	B^{+}	Black	Black	Black-White
14	Black	B^{+}	Black	Black	Black
15	White body Black-Brown patch	B^{W-B-BR}	White body Black-brown patch	White body Black-Brown patch	
16	Brown-Black	B^{Br-B}	Brown-Black	Brown-Black	

B^{+}

Fig 1(a): The phenotypes of Black Bengal goat.

B^{Br}

Fig 1(b): The phenotypes of Black Bengal goat



B^{W}

Fig 1(c): The phenotypes of Black Bengal goat

$B^{W\text{-}Br}$

Fig 1(d): The phenotypes of Black Bengal goat

$B^{Br\text{-}B}$

Fig 1 (e,): The phenotypes of Black Bengal goat

$B^{B\text{-}W}$

Fig 1 (f): The phenotypes of Black Bengal goat

$B^{Br\text{-}B\text{-}W}$

Fig 1 (g): The phenotypes of Black Bengal goat

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