CHARACTERIZATION OF THE WEST AFRICAN DWARF GOAT FOR CERTAIN QUALITATIVE TRAITS

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ABSTRACT

Records on 1344 West African dwarf goats collected between 1982 and 1992 were used in this study. The records were used to describe and determine the mode of inheritance for certain qualitative traits in the breed. All the goats have the stiff, short and straight hair coat type. The goat colour was very variable, irregular and this include white, black brown, pied and mixed colours. Nonetheless basic black colour predominate (53.3%). Basic white and brown goats account for 6.8% and 39.9% respectively. All goats studied irrespective of sex were horned. The goats also have a pair of teats each except for a case of supernumerary teats observed. Possession of beard is common in all breeding bucks, nonetheless, 11.6% of the females have beard. About two-thirds of the goats were wattled which could be bilateral (63%) or unilateral (6.2%) but no sex difference was observed. The mean lengths of body hair, ruff on bisket, wattle, beard in males and females were 2.90 ±0.80cm, 10.90±3,30 cm, 2.40±0.70 cm, 7.40cm±3.20cm and 9.20±2.7cm, respectively. Gene frequencies of 0.66, 0.08, 0.33 and 1.0 were obtained for presence of wattle, albinism, black pigmentation and non polled respectively.

Key Words: WAD Goat, Characterization, Polled, Wattle Beard, Coat Colour, Teats.

INTRODUCTION

The West African dwarf (WAD) goat which is the predominant breed in Southern Nigeria is yet to be characterised for qualitative traits, notably coat type and colour, presence of wattle, horn, beard and supernumerary teats. Though the WAD goat is adjudged as one of the most prolific in the world few reports exist on the documentation of its characteristics except generalised statements without the benefit of empirical data.

It is desirable to carry out a study of the inventory and characterization of the WAD goat. This is with a view to achieving conservation and preservation of the genetic resources in this period of indiscriminate crossbreeding. There is need also to study qualitative traits as possible indicators of genetic superiority or adaptability. This study was undertaken to describe the WAD goats for qualitative traits and determine the genotypic and gene frequencies of those traits.

LITERATURE REVIEW

The coat colour and the polled traits appear to be the most studied of the qualitative traits. The genetic basis of some of these traits have been enunciated for the temperate breeds of animals. The mode of inheritance of those traits differ widely in different breeds and species.

Ryder (1980) had earlier reviewed coat colour in sheep and concluded that four loci are involved namely A,B,S and E loci with the C locus as pigmentation inhibitors. The different shades and colours were also attributed to variations in the size, density and distribution of the pigment granules. Adalsteinsson (1991) recently described II gene loci, some interacting and some with multiple alleles that affect coat colour in sheep. Salmon and Berg (1984), however, reported that coat colour in cattle, is controlled by at least eight genes due to the fact that the metabolic pathways and subsequent degradation pathways involve at least eight enzymes.

Ricordeau (1981) reported that polled trait is caused by an autosomal dominant gene that has a marked difference in expressivity between the sexes. The incidence of wattle and coat pigmentation has been studied in Yankasa sheep

by Osinowo *et al* (1988). The only reported study on the WAD goat known to this author was carried out by Sponenberg *et al.* (1988) who studied frosted pattern and concluded that it was conditioned by autosomal dominant gene.

MATERIALS AND METHODS

The study was carried out using records obtained at the Goat Unit of the Obafemi Awolowo University Teaching and Research Farm, Ile-Ife, Nigeria. The period covered was 1982 to 1992. The management system of the goat was intensive (zero grazing) and this has been described by Odubote *et al.* (1992).

A total of 1,344 WAD goats were involved in the study. Each goat was described for coat type and pigmentation, wattle horn, beard and teat number. The decriptor list for goats as compiled by FAO (1988) was adopted for the study after necessary modification, for the pigmentation, the whole body was taken into consideration to derive a B-grade classification: 1-Black, 2-Black with white, 3-white, 3-white, 4-white with black, 5-white with brown, 6-brown, 7-brown with either black or white and 8-multiple colour.

The wattle is either absent or present and if present whether unilateral or bilateral. Horn and beard were also treated for presence of absence while teat was checked for supernumerary teats. Measurements were randomly taken on the goats for the following traits; lengths of beard, wattle, body hair and ruff on bisket.

Inheritance of the traits were studied using the breeding records. The genotypic and gene frequencies of the incidence of weinberg principle: $(p+q)2 = 1$ where p and q are frequencies of dominant and recessive alleles respectively in a random mating population (Falconer, 1981). Estimates of allele frequency for albinism was calculated by the method of Adalsteinsson and Wardum (1978).

$$q = m/m$$

where m = number of white animals and
M = total number of animals

Chi square analysis was used to test for sex differences and goodness of fit between observed and expected genotypic and gene frequencies (Steel and Torrie, 1980)

RESULTS AND DISCUSSIONS

Table 1 shows the incidence of qualitative traits. The genotypic ad gene frequencies are presented in Table 2

Coat Type:

All the goats examined have the stiff, short and straight hair coat type. The hair was however, more pronounced (i.e. longer) in the breeding males extending from the mane to the tail region along the longititudinal line at the back. The hair coat type is advantageous as it permits convectional heat loss from the animal surface in this hot environment

The length of the body hair ranged from 2.0 to 4.5 cm with a mean of 2.9±0.8cm (n=15). For the males, however, the ruff on bisket ranged between 7.0 and 16.0 cm in length with a mean of 10.9±3.3cm (n=10).

Coat Colour:

The coat colour was very variable and include white, black, brown, pied and mixed colours. In the same manner, some animals were spotted while others were speckled or with patches. The patterns of pigmentation were very irregular. The large variation is indicative that the WAD goat represents a traditional population in which no conscious selection effort has been exercised. No sex differences were found for coat pigmentation in this study.

Further grouping of the coat colours into the three major colours viz Basic black, white and brown (specified by Ryder, 1980) gave proportions of 53.3%, 6.8% and 39.9% respectively. The preponderant coat colour thus is black. This may be an adaptation to the humid tropics in contrast with the brown and white predominantly found in the Red Sokoto and Sahel goats respectively of the Arid Sahel zones. However, the black coat colour predisposes the goat to high heat load and probably high metabolic rate and increased

thyroid activity. The small body size has been described as an adaptive feature aimed at reducing the surface area and thus the heat load coupled with the hair coat type.

The mode of inheritance of coat colour is very complex as have been noted by Ryder (1980) and Osinowo *et al.* (1988). Attempts at fitting the data into a two, or three allele single locus genic model were not successful. This may be due to non allelic gene(s) epistatic to the coat colour loci. Hence, it was considered appropriate to determine the gene frequency for albinism and black pigmentation which is known to be controlled let by homozygous recessive and dominant genes respectively. And secondly, in view of the large number of colouration and modifier genes likely to be present, the frequency of the albino gene is low (0.08) while that of the black pigmentation is fairly high(0.33)

Another attempt at determining mode of inheritance was made using the basic colour frequencies since it is known that these colours are controlled by specific genes. This, however, did not also show good fit to Hardy-Weinberg expectation for two reasons: the phenotypic classes and the proportions obtained were smaller and higher respectively.

Wattle:

The size of the ear appendage varied from a length of 1.5 cm to 4.5 cm with a mean on 2.4 + 0.7cm (n = 10). It is also noteworthy that the colour of the wattle is usually the predominant coat colour. About two-thirds of the WAD goats possess the wattles. Thus it is not occasional as indicated by Wilson (1991). The expression of the trait could be bilateral or unilateral (on the left or right side of the ear). The unilateral expression is about 6.2% which is much lower than the bilateral expression. There does not seem to be any sex difference in the incidence of wattle, however, the mode of inheritance needs some clarification. It is known that wattle is caused by autosomal dominant gene. An attempt was thus made to fit the data into a single locus with 2 alleles genic model. The unilateral expressions were assumed to be due to heterozygosity while the homozygous recessive or dominant genes were postulated for non-wattle and bilateral expressions respectively.

When the above hypothesis was tested, it was found not to be in consonance with the results obtained. The unilateral expressions accounted for only 6.2% instead of the 45% expected if due to heterozygote condition. It thus suggests that the mode of inheritance is not the simple single locus with complete or incomplete dominance as reported by Casu *et al.* (1970), Singh *et al.* (1970) and Osinowo *et al.* (1988). There may be an additional modifying gene locus that is epistatic or it may be a case of multiple allelism at a single locus. To further understand the principles governing the inheritance, matings of unilaterally wattled goats (in 4 different combinations) and matings of bilaterally wattled goats should be studied. Though the functions of the wattle is not yet fully understood. There are speculations that it may be involved in heat regulation (body metabolism) thus suggesting that it may be an adaptive feature. Considering the fact that Yankasa sheep have a gene frequency of 0.15 for incidence of wattle compared with 0.56 in this study points to the fact that it is more important in the WAD goat and probably in the humid tropics

Polled:

All the WAD goats examined were horned irrespective of the sex. This is similar to the observation of Mason (1984) and Wilson (1991). The horns curl outwards and backwards in males while they are sharp, upward and backward pointing in the females.

That polled goat was not observed supports earlier reports that the gene for polledness in some breeds of goats is associated with a form of intersexuality and to cryptorchidism (Warwick and Legate, 1979). Secondly, it has been suggested that this might have led to selective disadvantage of polled goat. Thus, the gene frequency for polled trait should not be taken to be zero but that it tends to zero. The comment of Liu (1989) to the effect that it is not possible to fix the polled gene by artificial selection

because of the opposing influence of natural selection strengthens the suggestion above.

Beard:

This is a common phenomenon with adult and breeding bucks. Eighty percent of the males in this study exhibited the characteristic. However, it is not out of place to have females with the trait. In this present study 11.6% of the females showed it. Possession of beard is a secondary sexual characteristic and is under male hormonal control. Thus females showing the trait are likely to have threshold levels of androgenic hormone.. Nonetheless, the beard in females is usually sparse or scattered just as it is in young bucks. The beard measures between 5.0 cm and 10.0 cm with a mean of 7.4±3.2cm (n=8) in the females while it was between 8.0 and 14.0 cm with a mean of 9.2±2.7cm (n=12) in the males.

Teat:

All the female goat studied had a pair of teats each. However, a goat with 3 (supernumerary) teats was observed in the flock. The offsprings have 3 teats each. Due to the low level of incidence, it is suggested that it may be due to mutation.

The present study has evaluated data from a single flock, more flocks should be studied before definite conclusions can be made on the breed. Nevertheless, the mode of inheritance of coat colour and wattle should be further investigated especially for modifier genes using breeding records.

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Table 1 INCIDENCE OF QUALITATIVE TRAITS IN A FLOCK OF WAD GOAT

Traits	No of Animals	% of Total	
Wattle			
Absent	351	30.9	
Present	786	69.1	
:Left side	(19)	(1.7)	
:Right Side	(51)	(4.5)	
:Bilateral	(716)	(63.0)	
Coat Color			
Black	143	10.6	53.3
Black with White	574	42.7	
White	8	0.6	
White with black	60	6.8	
With with brown	23	1.7	
Brown	81	6.0	
		26.0	
Brown with either black or white	350	39.8	
Multiple colour	105	7.8	
Beard			
Absent	71	84.5	
Present	13	15.5	
Horn			
Horned (Non polled)	0	0	
Polled	934	100	

Table 2 GENOTYPIC AND GENE FREQUENCIES FOR CERTAIN QUALITATIVE TRAITS IN FLOCK OF WAD GOAT

	Genotypic frequencies			Gene frequencies	
Trait	p	2pq	q	p	q
Wattle				0.66	0.34
- observed	0.63	0.06	0.31		
- expected	0.44	0.45	0.12		
Polled				0.00	1.00
- observed	0.00	1.00	0.00		
- expected	0.00	0.00	1.00		
Albinism				0.92	0.08
- observed	(	0.99	) 0.01		
- expected	0.85	0.15	0.01		
Black pigmentation				0.33	0.67
- observed	0.11	(0.89	)		
- expected	0.11	0.44	0.45		