

Inheritance of coat colour in the Anatolian Shepherd dog

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Abstract

The predominant colour of the Anatolian Shepherd dog varies from a dark fawn to light red, with a variable black muzzle and face (mask). Evidence is presented that the colour is due to the dominant yellow allele (A^y) of the agouti locus. Two other frequent colours are white spotting, due to the piebald allele (s^p), and the chinchilla allele (ch). Two rarer colours are the agouti wolf-grey wild type (A^+) and a light fawn with a blue facial mask, due to the dilution allele (d).

Introduction

It is important to investigate the inheritance of coat colour variants for different breeds of dog, since it is becoming apparent that while a few generalisations can be made to cover all breeds, a number have mutant alleles not present in other breeds (Robinson, 1982).

The Anatolian Shepherd dog is one of a number of very ancient utility breeds of dog which have been developed over thousands of years in Eastern Europe and the Middle East. They are large, powerfully built, animals and are employed primarily as guard dogs for herds of sheep. They occur in a number of coat colours. Specimens have been imported into the United States and into Britain where they are being bred under strict supervision to maintain their integrity as a breed.

Material and results

The Anatolian breed is not numerically large and careful records have been kept by the breed clubs for almost all of the litters produced by the imported dogs and their descendants. These have been made available for a study of the mode of

inheritance of the various colours. The analyses of frequencies of phenotypes representing the mutant genes were accomplished by the method of truncated assortment, upon the assumption of complete or almost complete ascertainment (Emery, 1976). The mean litter size for the data is 7.02 ± 0.38 , which is a typical value for large bitches (Robinson, 1982) and is indicative that there has been no or little selective culling prior to registration.

The most frequent variety is known as fawn, in which the coat colour varies from fawn to light red. The majority of fawns have a melanic facial 'mask' covering most of the muzzle and face. The adult coat is basically fawn but has a variable overlay of dark guard hairs. Microscopic examination of the hairs revealed that most, if not all, of the secondary guard hairs are pale proximally to the skin but become more yellowish distally and are tipped with black pigment.

A number of grey colored individuals were observed which might be mistaken for dark fawns except that the distribution of dark coloured hairs was more general and the base of the hairs was light slate blue. Microscopic examination of the secondary guard hairs revealed that these are darkly pigmented except for a subapical band of

yellow. These individuals have the appearance of the wolf-grey genetic wild type of the dog. The first category of entries of Table 1 indicate that the fawn behaves as a dominant to the grey. It may be inferred that the fawn colour is produced by the dominant yellow allele (A^y) and the grey by the wild type allele (A^+) of the agouti series (Little, 1957; Robinson, 1982). This finding augments the few cases in the literature of the dominance of A^y to the wild allele. The presence of the melanic facial mask is additional evidence that fawn is produced by A^y because recessive yellow (e) is epistatic to mask (Robinson, 1982).

A large proportion of Anatolian dogs have white markings, which is confined to the face, shoulders and stomach for the lighter marked individuals, but over much of the body for the extensively marked. The pertinent entries of Table 1 indicate that the white markings are inherited as a recessive to the self (non-white). The white pattern may be ascribed to the piebald allele (s^p) of the white spotting series of alleles (Little, 1957; Robinson, 1982). It is known that the expression of white is extremely variable for this allele (Robinson, 1982). The eyes of the piebald are dark brown except in some extremely white individuals when the irises may be blue or heterochromatic brown/blue.

The colour referred to as white by breeders is not truly white but is a light cream. The eyes are a normal dark brown and the nose is black. The last entries of Table 1 indicate that the white colour is inherited as a recessive to fawn. The allele is depicted as chinchilla (ch) since the phenotype is fully compatible with the description given by Little (1957) for the allele, where the yellow pigment is degraded to cream or white while the black is unaffected (eyes and nose).

A single blue diluted dog has been reported, bred from normal fawn parents. The body fur was pale fawn and the mask was distinctly bluish. The irises of the eyes were light brown and the nose leather was slate-blue, two features which are typical of the dilution (dd) phenotype (Robinson, 1982).

The presence of the melanic facial mask is not an aspect of the dominant yellow phenotype. The

Table 1. Assortment of the mutant alleles dominant yellow (A^y), piebald (s) and chinchilla (ch) in the Anatolian Shepherd dog.

Mating	Observed		Expected		χ^2
	A^y	+	A^y	+	
$A^y+ \times A^y+$	7	5	8.3	3.7	0.6
$A^y+ \times ++$	4	3	3.5	3.5	0.1
	+	s	+	s	
$+s \times +s$	92	35	90.5	36.5	0.09
$+s \times ss$	38	36	42.4	31.6	1.07
$ss \times ss$	—	14	—	14	
	+	ch	+	ch	
$+ch \times +ch$	40	15	40.1	14.9	0
$+ch \times chch$	25	12	18.4	18.6	4.7
$chch \times chch$	—	10	—	10	

χ^2 has 1 df.

majority of fawn Anatolian display variable expression of the mask but a few do not. It was difficult to obtain precise data on the inheritance of mask but the observed variation implied that mask is probably polygenic determined instead of being supposedly monogenic (Little, 1957).

Discussion

The Anatolian Shepherd dog is essentially a working breed and has been bred for thousands of years with scant regard for coat colour. The result is that the dog populations of Eastern Turkey are polymorphic for colour, although the predominant colour is fawn. Miss Naltaka Czartoryska has travelled throughout the region and her photographic records indicate the presence of black and brindle, two known colour mutant phenotypes (Little, 1957; Robinson, 1982), in addition to the colours described in this report.

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