PIEBALD MARKING IN JACOB SHEEP AND OTHER ANIMALS

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Those of us who arc involved in breeding Jacobs find that to arrive at the standards required is not easy to achieve and this is particularly true when considering the acceptable relationship between the black and white coloured areas. It may be the breeder has in mind a level of marking and decides that to attain this goal requires the establishing of a strain, to enable the end result to be more controlled.

The following study may assist breeders in recognising certain characteristics, and from these observe from which lines the best youngsters are coming, so having better knowledge as to the predominant good properties and faults in the different families.

A background of theory is not necessary to breed livestock, but a basic understanding of the underlying principles should make it possible to grasp more fully the specific inheritance patterns of Jacob Sheep, and save time and money.

There arc always exceptions to the rule. We are dealing with living organisms, and we have to contend with influences which are not fully understood even in these days when so much biological information and breeders' experiences are available to us The particular area on which I wish to focus is that of the piebald marking in Jacob Sheep

Research in recent years has greatly extended the knowledge of the inheritance of colour in animals, particularly the colour of wool.

The chromosomes provide the blueprint from which new cells are made. Sheep have 54 chromosomes carried in pairs (Diploid).

A "Haploid" number 27 is donated by the Sire and the other 27 from the Dam, The chromosome pattern for each individual is

unique. Chromosomes are made up of long molecules of Deoxyribonucleic Acid' of DNA, and are divided into sections. These sections are called Genes. They carry the information concerning shape, colour, size etc. Both genes of a pair may be the same or they may be different. Sometimes they act together and sometimes conflict, with one, being more powerful or dominant and the other recessive. Therefore a chromosome is made up of many genes linked together.

Nine colour genes have been identified in sheep, but only four of these are of any importance in sheep of Northern Europe, these are the genes A, B, E and S.

As colour is an important consideration to be kept in mind when breeding Jacob sheep, my own interest in this area has progressed towards the genotype and the associated colour patterns of these sheep and other animals. According to GLH Alderson (ARK vol. VI, No 4) "White markings on sheep are controlled at the S locus, and the extent of the white markings is influenced by the interaction between genes at the S locus and A locus. The most distinctive white marking is the Piebald pattern seen in the Jacob Sheep, which has the following genotypes;

Ed Ed Awh Awh BB ss or Ed Ed aa BB ss "

Of greatest interest to Jacob breeders are the S series alleles, which determine whether the animal will be solid coloured on non - solid. Gene ss

This gene produces the distinct white Piebald marking when in recessive form. When the Jacob is crossed with most other British breeds, which have the dominant S gene for solid colour, thus masking the recessive's' (piebald) gene, the dominant Ed ensures that the progeny are black.

After direct correspondence with Dr M L Ryder, a wool Biologist, in 1989 his comments were as follows:,

"White spotting is produced by genes at the S locus. There are two genes here, S or big S producing unbroken colour in pigmented sheep, and s or little s which produces broken colour ie. white patches. All black and brown sheep must therefore carry the big S gene, which is dominant to little s.

Piebald sheep are therefore homozygous (pure) recessives ss. As an aside it can be remarked that piebald sheep are therefore coloured animals with white markings and not white sheep with black markings, which is what they appear to be"

Dr M L Ryder and S Adalsteinsson in their revised paper (1986)

"A Note on differences in coat structure between the black and white areas of piebald lambs" state, "It is known that the recessive ss (white) gene prevents melanoblasts (black colour cells) from migrating into certain areas of the skin, and it appears from these observations that the absence of melanocytes leads to the growth of finer wool in the white areas. Selective breeding for greater and greater areas of white should, according to this evidence, eventually lead to not only a completely, white fleece but also a finer one. The white patches on piebald animals can be regarded as areas where the recessive allele in homozygous form is active, while the effect of the ss genotype is not manifested in the non white areas. The white patches can therefore be regarded as a localised effect of the recessive piebald ss genotype"

Variation of Gene Arrangements

From our own experiences of breeding Jacobs, there appears to be a tendency for a reduction of black across the body of the animal. The black being broken up in certain white stronghold areas first, beginning with the belly followed by brisket, legs, chest, rump, head and spine.

The white appears to become 'over dominant' covering areas normally occupied by black. If in extreme form the white may

obliterate the head, apart from small black eye patches and neck band.

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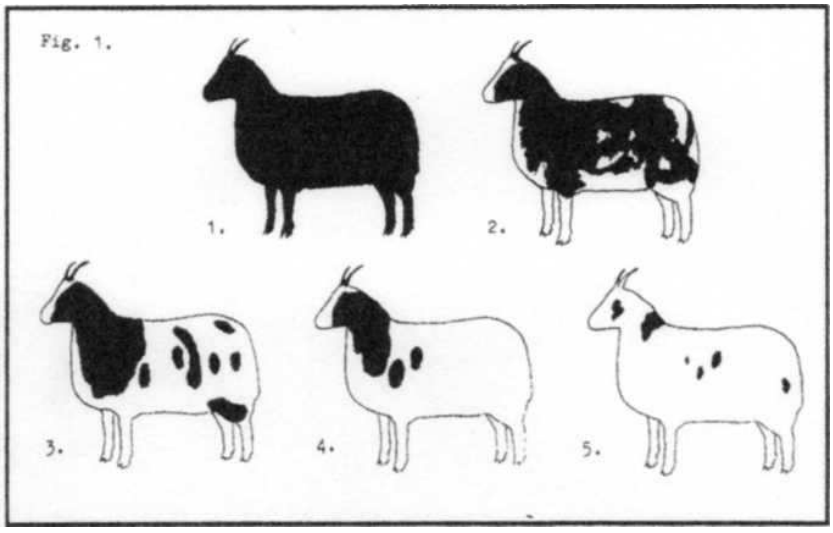

It has been noted that the amount of white often appears to be distributed between sets of lambs when born, and these particular basic white patterns may be seen to emerge:

Fig I

1Self (solid) coloured. Black and brown sheep carrying dominant S.

2Dark Piebald. Pure Jacob with very little ss activity. White on belly, legs, chest, rump, and median blaze on head.

3Spotted Piebald. Well coloured head and shoulders, with patches and spots of black distributed on a white background.

4White Piebald. Well coloured head and neck area, with one or two black patches on body.

5Extreme-white Piebald. Black areas confined to head, neck and flanks. The random 'overlap' patterns suggest combinations of the above, controlled by the recessive s gene alleles.

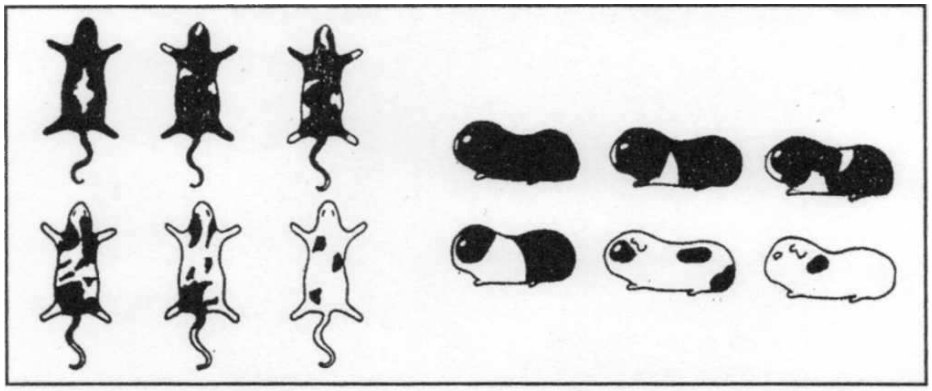

Fig 2

Fig 3

Fig 2
White spotting in Mice.
The amount of white, and to some extent, the pattern can be influenced by selective breeding, the finer points are determined more or less by chance, according to R Robinson in his book "Colour inheritance in small livestock'. He goes on to say, "As the amount of white increases, the blaze on the head becomes wider. The lower portion of the legs and end of tail are usually white. Eventually the animal becomes all-white, with the coloured areas split up as patches on the sides of the head, over the shoulders, rump and tail. It is possible that a chance combination of genes may be producing exceptionally well marked animals. Unfortunately, it is too likely that the actual placing of the patches is under weak genetic control, and so it will be impossible to produce ideally marked animals to order".

Fig 3
White pattern in Cavies.
There seems to be only one major white spotting gene, s, although the variation of amount of white is remarkable. The white pattern may vary from animals with a small white spot on the nose or forehead and white feet to others practically all white except for one or two islands of coloured fur. Cavies with a small amount of white are said to have low grade spotting and those with great patches of white are high grade. The gene is incompletely recessive, so Ss usually but not invariably, shows low grade spotting; while ss may show almost any grade of white from low to high".

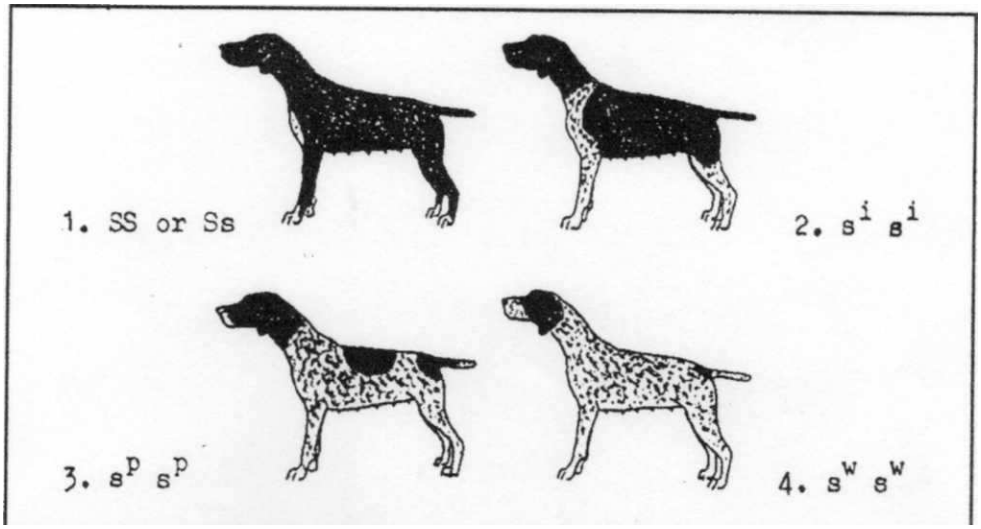

Fig 4
Coat Colour and Pattern in the German Shorthaired Pointer (GSP)
According to Georgina Byrne, author of the book 'Der Deutsch-Kurzhaar', "The GSP appears to have all four alleles, S, s.i s.p s.w. The alleles which determine the amount of solid coloured areas in the non-solid coat are as follows:-

2Irish spotted (s.i)

3Piebald spotted (s.p)

4Extreme-white piebald (s.w.)"

When using symbols to represent the alleles of a gene, scientists use capital letters for the dominant alleles and lower case letters for the recessive alleles. Research in this area suggests that piebald marking in Jacob Sheep may be inherited in a similar fashion to the German Shorthaired Pointer, the recessive alleles interacting and producing various amounts of white. (See Fig 4) Therefore, a heterozygous (mixed) complexity of the various 's' alleles appears to be a major factor governing colour pattern in Jacob Sheep,

Only a portion of the variation of pattern may be genetic, the remainder due to chance development of the white cells during embryonic growth. Culling of miss-marked' individuals, appears to be the only way of ensuring that the erratic spread of white does not become a real nuisance. On the whole, breeding results show

that individuals with very little black on head and neck region may be regarded with suspicion for being weak of any blueprint' for a black pattern.

Research at this level is limited, but empirical study suggests that the blueprint is nothing more than a reflected image, (the phenotype) Its outline and relief being varied and changed, for better or worse according to chemical, radiation, and environmental stimuli.

Breeders who have developed their own type or family, soon discover that certain colours are heralds of disaster. It is known that characteristics of different kinds can be linked, whether this be advantageous or not, these may be passed together through the generation of breeding.

Breeding results show that maternal influence of coat pattern has a marked effect upon progeny colouration. On the average, the best results may be obtained by breeding from only well marked stock, or those which are a little on the dark side, as a second string. The breeder is then doing his best to tip the chances of success in his favour.

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