Large Munsterlander Coat Color Genetics

an information page for the owners and breeders of Large Munsterlander Pointers (Grosse Münsterländer)

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"The Study"

My husband, Joe Schmutz, and I have bred Large Munsterlanders since 1977. Therefore I have a greater personal interest in the coat color genetics of this breed than any other. They have been included in many of the DNA studies done in my lab over the years, and so I decided to summarize the results pertinent to this breed. The LMs tested live/d in North America, although some were imported from Germany. A few LMs have also been imported from the Czech Republic, Austria, and England, so there is some influence of those gene pools in some of these dogs.

The FCI standard states that all Large Munsterlanders are black and white. They can be either ticked or plated, in terms of their white markings. However, there are some LMs that are other colors, because as in all breeds, other alleles have either persisted from the ancestors of LMs or have crept in through accidental or purposeful matings with dogs of other breeds.

K Genotypes

The gene causing black in most dog breeds, including the Large Munsterlander, is *beta-defensin 103 (DEFB)*. The locus is known as K. Although there are three alleles at the *K* locus, K^B, k^{br}, and k^y, only K^B should occur in LMs.

However, in Britain at least, there have been LMs born that are black-and-tan for some years. These dogs are k^y/k^y instead of the traditional K^B/K^B. The K^B allele prevents the alleles of the *A* series caused by the *Agouti Signal Protein Gene (ASIP)* from showing in the phenotype. Technically, K^B is epistatic to the *A* alleles. LMs in Brtain, especially those that have had a pup, sibling, or parent that is black-and-tan should probably be DNA tested for *K* and if they carry the k^y allele, they should at least not be bred to another carrier.

There was a photo of a Large Munsterlander named "Molly" in Scotland, dated 2007, who is a tricolor or black-and-tan. One can barely detect her tan in the photos but if one looks closely at her legs behind in the photo with her and her cup from a training club, a bit of tan is visible. The author calls the color brown, but tan is actually a shade of red from the pigment phaeomelanin. No dog can have both brown and black hairs because a dog can have only one shade of eumelanin pigment at a time and black, brown and gray are all shades of eumelanin.

Agouti Genotypes

Note that although most LMs carry the a^t allele at *ASIP*, some LMs also have the a^y allele, which is dominant to the a^t allele. Because LMs have traditionally always been K^B/K^B, there has been no selective pressure on the *ASIP* alleles.

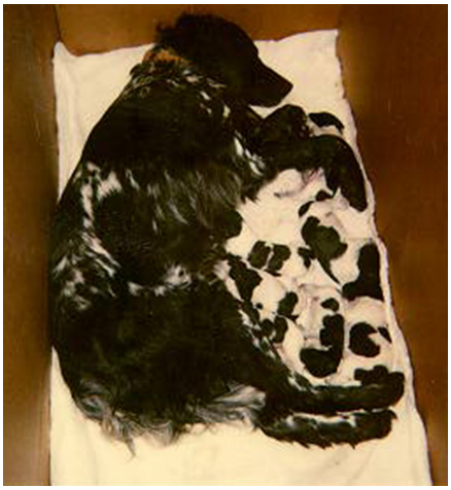
If the a^w allele occurs at all, it would be extremely rare since wolf sable did not occur in versatile hunting dogs. At the bottom of the dominance hierarchy is "*a*". This allele causes "recessive black" when homozygous but occurs only in herding breeds, with rare exceptions.

White Spotting

Although German Longhaired Pointers can be either solid brown or brown and white, these two variations were not included in the LM. All Large Munsterlanders are black and white. The white areas on LMs occur in a random pattern, which would be called piebald in some breeds. Therefore all LMs have a s^p/s^p genotype. The mutation causing piebald spotting is a SINE insertion in the promoter region of the *MITF* gene. Since all LMs have this, or are "fixed" for the s^p allele, there is no reason to test for this. In the German Longhair, the solid brown dogs would have at least one *S* allele.

Ticked versus Plated

At birth, all LM pups have white areas and black areas but no ticking or roan. Ticking is the name used for the small black spots that occur in the white areas of the LM. Ticking shows first on the belly at a few weeks of age, but gradually shows in all the white areas, if the dog has at least one allele for ticking. If not, then a few small black spots may still develop in the white areas, but not as many. This pattern is called "plated". At the present time, the gene causing ticking versus plated has not been published.



The family of LMs shown below includes the 7 Sunnynook J litter pups with both parents (top) imported from Germany. They illustrate the variety of markings in a single litter. As adults, the distinction between a ticked and plated dog is not that obvious.










Typically plated pups will be born with pink on their pads and perhaps even a bit of pink on their nose leather. Usually these pink areas gradually become black.

Two research groups published manuscripts about ticking and/or roan in 2021. Unfortunately their findings do not completely agree, although similar. Kawakami et al. (2021) in the Boyko group, actually studied Dalmatian spotting which has been called ticking by some dog coat color books and papers. This is NOT the ticking of Large Munsterlanders, however. They reported that Dalmatian spotting is caused by a duplication in an usherin gene (*USH2A*).

Brancalion et al. (2021) in the Wade group studied ticking and roan in English Cocker Spaniels, and then in Springer Spaniels. They concluded that ticking was caused by various mutations near an usherin gene (*USH2A*) and that the combinations of these mutations helped explain the variety of phenotypes. This manuscript describes with the situation in Large Munsterlanders better, but unfortunately no definitive DNA test is suggested.

Brown, *B* Locus Genotypes

Tyrosinase Related Protein 1 (*TYRP1*) is the gene responsible for brown coat colors in dogs (and mice and cattle and cats). Three different mutations in this gene all can produce brown when homozygous or in combination (i.e. compound heterozygote): b^s, b^d, b^c. Wisely most, if not all, DNA testing companies just report this group of alleles as *b*. The wild type allele that is necessary for a dog to be black is *B*.

Because the Large Munsterlander was once part of the German Longhair Breed, there are LMs that carry brown for ancestral reasons. Germany also re-introduced a few select German Longhaired Pointers into the Grosse Munsterlander as recently as 15 years ago. This was before the mutations causing brown were known and DNA testing was obviously not available. But since all German Longhaired Pointers today are brown or brown-and-white, and all the Large Munsterlanders used were black-and-white, all the pups produced in these purposeful breedings were *B*/*b* and black, not brown. However, brown-and-white pups are occasionally still born but these are not breed since they do not meet the FCI standard for the LM.

Gray, *D* Locus Genotypes

"Gray" is used as the name for diluted black in the Large Munsterlander. In other breeds, the term "blue" might be used. Gray has entered the LM a long time ago, but the origin is not known and not really important.

The locus causing gray or "dilute" black is classically known as the *D* locus. Gray dogs have a *d/d* genotype. Unfortunately, in the LM, and several other breeds this genotype also leads to the disorder known as Black Hair Follicular Dysplasia. For reasons that can't be explained, the LM is probably the breed that has the most severe symptoms of this disorder. Other long-haired breeds are also more seriously affected than short hair breeds, but the LM's gray hairs start breaking very early. This leaves the affected dog almost bald in all the parts of its body that have gray pigmentation and a normal coat in the white areas. When the dog moults and new hairs grow in, the gray ones are long for a short period and then break off again.

The gene causing gray is *melanophilin (MLPH)*. This gene makes a protein that is part of a trio of proteins that rachet pigment up into the hairs. When melanophilin is not correctly formed, as in dogs with a *d/d* genotype, the pigment is not evenly distributed and so the hair looks gray instead of black. Because pigment adds strength to hair, the gray hairs have stronger and weaker areas and this leads to breakage.

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