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GENETIC SYMBOLS FOR MUTATIONS IN COLOR AND FUR STRUCTURE IN CHINCHILLAS

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Abstract

This article is the first to propose universal genetic symbols for chinchillas with different colors and structures of fur, obtained as a result of selection. In the interpretation of the standard (gray standard chinchillas), I want to amend an ancient idea that wanders from one source to another. Its essence is that once some author found logic in recording the genetic code of a standard chinchilla in the form of an alphabetical listing of all known colors received from it. Then, agreeing that it was inconvenient, he proposed to move to a simpler "conventional" designation of the standard with any letters or their combinations. In the same logic, it is argued that the gray color of a standard chinchilla is the product of a mixture of all its "constituent" colors. These arguments are wrong. A mutation that appears once may repeat itself (or will occur periodically) after an indefinite time. The standard chinchilla no longer has it, that is, the likelihood that it will "generate the same thing" again sometime in the genotype (or phenotype) is negligible.

Keywords: Chinchillas, color mutations, genetic symbols

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1. Introduction

The long-tailed chinchilla (Chinchilla lanigera) has been bred in captivity for about a hundred years, both for skins and as a pet. During this time, new colors and mutations with a modified fur structure were bred in America and Europe. In almost every case, alphabetic characters were assigned to these new mutations, and the North American notation system and the European one gradually took shape. In America, the system is expressed more or less uniformly (USA and Canada), in Europe there are several variants formed in countries where chinchilla breeding is especially well developed (Denmark, Germany, Poland). In Russia, where research on the content of chinchillas is carried out relatively recently, works on the genetics of colors are still rare (Kiris, 1971; Kozlov, 2003, 2013).

At first glance, the alphabetic symbols assigned to mutations at different times in different countries seem to be quite logical and working, they are used both in scientific literature and in the everyday life of chinchilla breeders - practitioners. However, in all these systems there are errors that no one fixes for decades - some real mutations have not been introduced into the systems, but they do not exist (Barabasz, 2008; Nes et al., 1988). The reason for the current situation with fictitious mutations is too quick scoring and the introduction into everyday and literary circulation of a new color variant and other external changes in individual chinchillas. After several years, some of them actually turn out to be new mutations, and some are just variants (morphs) of already known ones, or even the same, but "open" in another country. The Russian proverb is very suitable here: "the word is not a sparrow, it will fly out - you will not catch it" - once written names of non-existent colors of chinchillas (in most cases with their genetic symbols) continue to wander to this day through articles and books.

2. Purpose of the Study

In my work, I want to correct these errors and propose to make a number of changes and clarifications, as well as add new genetic symbols for colors and other external signs of chinchillas, which will be the most accurate and convenient.

3. Research Methods

Research has been carried out since 2001 on an experimental chinchilla breeding farm located in the Moscow region. At the same time, there was a periodic purchase of chinchillas from the farms of Poland, Germany, Belgium, Denmark, the Netherlands and the USA.

For 18 years, this farm has collected a collection of all known chinchilla mutations in Europe and America. They have been tested for purity over several generations - to exclude the possibility of unexpected carriage of recessive genes responsible for the structure and color of the fur. Currently, this is the most complete and pure genetic base of color mutation chinchillas in Russia.

In the course of the work, it turned out that in the genetics and breeding of chinchillas there is no single mechanism for the genetic symbols of mutations in colors and fur structure in these animals, which introduces confusion and discrepancy among breeders - fur breeders. The aim of this work is to propose a clear structure of the genetic symbols of the known colors and structure of the fur of chinchillas.

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4. Findings

Below is a brief description of the external mutation of the chinchilla and its genetic symbols. Dominant mutations are highlighted in capital letters, that is, those that are visible in the phenotype in the next generation and are not transmitted in the form of carriage. Capital letters denote mutations that are transmitted in the genotype in the form of a carrier and can manifest themselves in the phenotype if there is a pair of the same gene in an individual.

In the designation of color mutations, it is most convenient to use the approach adopted in Denmark regarding the color of fur animals: one gene - one letter. This method simplifies the writing of several signs of one chinchilla in one line and reduces the likelihood of errors in misinterpreting the letters denoting these signs.

SS - Gray standard chinchilla without division into agouti and non-agouti, as can be found in some sources. The bottom line is that there are a lot of intermediate options between a clearly zoned colored hair and a non-zoned colored hair (uniformly gray - not agouti), and there is no point in giving each of them its own genetic symbol.

In the interpretation of the standard (gray standard chinchillas), I would like to amend the ancient idea that wanders from one source to another. Its essence is that once some author found some logic in recording the genetic code of a standard chinchilla as an alphabetic listing of all known colors obtained from it. Then, agreeing that this is inconvenient, he suggested moving to a simpler "conventional" designation of the standard with any letters or their combinations. In the same reasoning, it is argued that the gray color of a standard chinchilla is the product of a mixture of all its "constituent" colors.

These arguments are erroneous. Do not assume that a mutation that appears once will arise (repeat) again (or it will occur periodically) after an indefinite amount of time. In a standard chinchilla it is no longer there, that is, the probability that it will "generate the same" again sometime in the genotype (or phenotype) is negligible. In the history of chinchilla breeding there is an example of "repetition" only with recessive beige. However, if we consider the history of these repetitions more carefully, relying on the history of the settlement of the chinchillas themselves in America and Europe, then we can assume a more prosaic version - the spread of the recessive run gene in the carriage took place and then the "discovery" of this "new" color on another continent and in other countries.

You can try to mix all the known chinchilla colors, but the gray color will not work - this is a proven fact. The dominant colors - beige, black velvet, Wilson's white, in their combination, give a color more close to white. Carriage of all other colors will not affect the color of the animal.

There remains only one option for the appropriateness of writing in a long line of letter designations of the carriage of a gray chinchilla of recessive colors. In practice, this is done if a given chinchilla, through multiple crosses in its ancestors, really received this carriage. At the same time, the percentage of the probability of carrier transmission for each color (feature) is often indicated. For example: Svs (a50%) - the standard carrier of violet and sapphire (without specifying the percentage, full confidence in 100% carrier is assumed) and angora 50% probability.

SV - black velvet (black velvet). A dominant mutation that always contains a standard gene. The most popular among both furriers and amateurs. The head, back to the base of the tail, thighs are black.

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Below from the throat and also to the tail - white fur, gray sides. The color can be characterized as "black-backed", which is also found in other animals, for example, the German shepherd.

The name of the mutation sounds like black velvet, velveteen is translated into Russian as velvet. But in Russian there is also a separate word velveteen and a corresponding type of fabric ... not like velvet. Thus, although the chinchilla is called "velvet", it is actually "velvet". Stupid situation in the English style, but that's not about that now.

SW - white Wilson, bears the name of the person who first received it. The mutation is also "forced" to include the standard gene, but be white. The classic color is uniformly white fur, but the wrists, lower legs, base of the tail and tip of the muzzle are dark gray to black. The eyes are also black. In nature, you can find other animals with this color distribution - for example, Siamese cats, California rabbits, that is, the color of the Himalayan type.

Vavilov's Law of Homological Series (1920), a well-known phenomenon described for other domestic and wild animals, including fur-bearing animals, is most clearly traced in the variant with white Wilson (Markovich et al., 2012). This allows us to assume the emergence of new mutations of chinchillas, for example, with severely shortened hair (found in cats, rabbits) or even with bare skin (guinea pigs, dogs, cats at et.).

The white Wilson color is quite diverse - in addition to the classic Himalayan version, individuals with a different type of white color distribution are often found. With randomly scattered dark spots on a white background (except for the belly), with evenly distributed dark hair on the upper part (silver effect), finally completely similar to the standard color, but often with a small patch of white fur on the tail, paw or body, betraying the presence gene Wilson.

SB - Tower beige, also bears the name of the chinchilla breeder who gave us this mutation. The color can be described as beige, fawn, apricot, light brown. The eyes are ruby. It is used in fur production and is popular with amateurs. Unlike Wilson and black velvet, it can do without the standard gene if two beige ones are present in the animal.

BB - Homosexual color - chinchilla containing two beige genes without the presence of the standard. The color is very light apricot, the eyes are red. When crossed with a standard color or any other, it always gives away one beige gene. Since one beige gene is dominant, all the offspring from a homo-beige chinchilla are beige (hetero-beige).

A few more words about the discrepancy that everyone is used to and no one notices. When crossing a beige chinchilla and a white Wilson chinchilla, you can get a triple dominant color: white-beige (SWB). But traditionally the word beige in this combined color is replaced by pink and already sounds like "white - pink".

The ebony gene in genetic symbols is commonly written as e (E) - ebony. The presence of the ebony gene manifests itself as a darkening of gray to completely black, which extends to the lower side of the body. Eye color in all combinations with ebony is also black. The color is cumulative - the more often chinchillas with the ebony gene are crossed with each other, the darker the offspring turn out (with the selection of darker in each next generation). With the reverse scheme - crossing a very dark ebony - chinchilla with standard ones - in 3-4 generations we will get offspring that looks completely similar to the standard one, but with the ebony gene carriage.

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The degree of darkening - saturation occurs by the gradual combination in one animal of 4 genes of ebony - color, which pass, as they accumulate, from recessive to dominant form. It looks like this:

Se is the standard carrier of the ebony gene (not visible in the phenotype). When crossed with a pure standard, this gene can be passed on to offspring in half the possible cases.

ee (or you can write E) - light ebony, appears as a standard color with a light gray neck, chest, belly. The designation of the S standard in light ebony no longer fits, since when crossing a light ebony chinchilla with a pure standard one, all offspring will be carriers of the ebony gene: ee x SS = Se, Se ... (or E x SS = Se, Se ...). At this "stage" the ebony gene still works as a recessive one - when crossed with a chinchilla without an ebony gene, the offspring receives it in the carrier.

eee (or it is appropriate to use the spelling: Ee) - "enhanced", medium ebony - the overall color of the animal is darker, the bottom is slightly lighter. When crossed with a pure standard, offspring can look both light ebony and "pure" standards (but with the ebony gene carrier). Here the gene in half of the cases manifests itself as dominant - noticeable in the offspring.

eeee (due to its dominant action, it is appropriate to write as EE) - dark ebony, homoebony. A chinchilla with such a concentration of the ebony gene looks like absolutely black. When crossed with a chinchilla without ebony, all offspring will be dark: EE x SS = ee, ee.

cc is the common designation for the albino gene. Indicates no pigmentation. Looks pure white, eyes transparent light pink. Chinchillas - albinos often have eyes of an unusual shape - in some individuals they may seem much smaller (relative to ordinary ones), in others they may have an oblong, like in humans, shape. Also, while breeding albinos, I noticed an interesting fact - being in the phenotype, this gene sometimes still "declares its presence" - discoloring, for example, the hair on the tip of a chinchilla's tail or noticeably lightening the overall color intensity.

vv - violet - for a more accurate identification, it is more correct to call this mutation Afro-violet. It was obtained in Rhodesia, at present, the color of the chinchilla conditionally corresponds to the name, since by selection selection it has changed towards a rich blue and resembles the fur of a blue mink. However, even 17-15 years ago, chinchillas with a clearly purple (like ink on a fountain pen) tone could be found on Polish farms.

gg - German violet chinchilla, has nothing to do with the previous mutation. The color of the fur resembles an eggplant. I suggest using g (german) rather than d (deutsch), since d will be used to denote another mutation. (Kozlov, 2013).

ss - indicate the color of the sapphire. The most accurate correspondence of the name to the color of the fur of the chinchillas of this mutation. An interesting feature, which even owners of sapphire chinchillas do not always pay attention to - the eyes of these animals (and of standard carriers of the sapphire gene), with a certain refraction of light, very often cast a pinkish color. A stable pink color in the eyes of gray chinchillas (in any light) is visible when they simultaneously carry the sapphire and albino genes. This fact sometimes helps to clarify the controversial issue of carriage of the sapphire gene in other colors.

ll- white Lova (Lowe recessive white), named after a Canadian breeder who announced the appearance of this mutation among his chinchillas in the early 21st century. The fur looks almost white, but with a yellowish (golden) tint.

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pp - black pearl mutation. The first letter of the word pearl is used. Perhaps the youngest mutation, obtained in Poland by farmers Kuharchik in 2008. The color is very effective and popular - the chinchilla is completely black except for the white bottom - neck, chest, abdomen.

ff - gene for curliness, the first letter is taken from the word frizzy - curly. Similar names for this mutation are rex, curly, curl. Obtained in Germany from ebony chinchillas. The curl gene is obviously of the same "collective" character as the ebony gene. The degree of curliness manifests itself both as clearly distinguishable wavy hair (usually on the belly) and as expressive, well-defined curls throughout the body. The mutation still requires a long breeding work in terms of stable fixation of traits.

aa - gene for elongated hair, angora. It sounds like royal persian angora, it was bred in the USA, but for some reason the name is often written "royal" and "persian". The mutation is very effective and popular among Russian chinchilla breeders.

hh - gene for "fading" hair, gray hair, from the word hoary - whitened with gray hair. The common name is Californian graying. A very rare gene that appears on the hair of a chinchilla by about seven years in the nose, around the eyes, on the front legs. Probably, in the future, the "prospect" of the development of this gene can be assumed as spreading to other parts of the body, for example, the scruff and back, and as a manifestation at a younger age. This can happen if the gray hair gene is cumulative. Potentially dangerous gene for fur production.

dd - dwarf gene. To designate this gene, I took the first letter of the word dwarf (dwarf, gnome), leaving the letter g for the German violet. Dwarfism is common as recessive genes in many chinchilla populations on farms and nurseries. Moreover, the designation dd can be considered so far "conditionally collective", since it is obvious that there are actually several dwarf genes and they are responsible for different variants of manifestation. Over the course of several years on the farm, I have noted at least two of the most clearly expressed forms: the first - extremely small animals with relative preservation of the proportions of the whole body, the second - animals a little larger, "stockier", with a head of normal size, but with a very shortened body, limbs, tail. Perhaps, with the accumulation of material, experts will consider the manifestation of dwarfism more carefully and will give its various forms - genes the appropriate designations.

Returning to the homologous series, I want to say that getting a new mutation of chinchillas with bare skin is a close event. This fact will depend only on the attention and care of the owner. The gene for bare skin (underdeveloped hair) already exists among some chinchilla populations, especially those bred for short fur lengths. Perhaps, the alphabetic character nn (nudy) will be assigned to bare-skinned chinchillas.

About a year ago, my chinchillas had such a baby - a small amount of hair was only on the head and on the tip of the tail. Normal size, quite strong, he died a few days later, and in the last two days he was lethargic and depressed. Unfortunately, I did not realize in time that such chinchillas need additional heating. The periodic presence of the female next to him - during feeding - was not enough.

At that time, with a general temperature background in a room with animals of 14-16 degrees, he separately needed a temperature of 28-30 degrees. The cause of death is simple and very annoying. I suppose that on the farms of Europe, America and, perhaps, Russia, such cubs can sometimes appear. But

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with the general approach - maintaining constant coolness on the farm and keeping chinchillas on a mesh floor - naked chinchillas have no chance of surviving.

5. Conclusion

In conclusion, I consider it necessary to recall and comment on the names of non-existent mutations that can be found in the literature.

Agouti or not agouti with the highlighting of a separate genetic symbol - this is all gray standard color.

Cannon soot (gun soot) - these names once referred to the mutation black velvet (black velvet).

Misty (foggy), silver, motley - different names for the morph of the white Wilson color.

Stone's White is an albino, but a morph with a resized eye.

Coal, charcoal, mahoniowa charcoal, węglowa are different names for ebony variants.

Goldbar - aka white Lova, (origin USA, California).

Sullivan's beige, Wilman's beige, clear Polish beige (Rzhevsky's beige) - nowadays mutations are lost for accurate identification. The oldest mention of recessive beige mutations sounds like Sullivan beige (USA), and the current one sounds like white Lova (goldbar).

Bluesleit is a sensational "new" mutation in its time, which in fact is just a poorly expressed color of black velvet, the carrier of the German violet.

Champagne is an outdated name for homo-beige chinchilla in Germany and Denmark.

Pearl is an outdated name in Germany for the pink and white chinchilla (SWP) of the pinkish morph.

Sronata - (srokata, piebald) occurs in the Polish description as white spots on a general background (Barabasz, 2008). The presence of a separate recessive spotting gene is assumed. For 10 years of monitoring Polish farms and exhibitions, I have not found a chinchilla with a term color (as well as a clear Polish beige chinchilla). However, descendants of an albino chinchilla of Polish origin exhibit this white spot, which I described above in this mutation. I suppose that the gene for spotting may appear in chinchillas in the future, but for now, instead of sometimes it manifests itself as an albino carriage.

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