

Penciled and locus Z

Penciled is a gene that acting somehow similar to Grizzle and Undergrizzle genes. This gene affect the color of a certain part of the feather in different areas of the body. Penciled is an autosomal recessive character which causes some feathers almost white with a dark border.

There is the assumption that Penciled ("pc" or "z*pc"?) is an allele of "Z" Locus. In this sense, there is a study conducted by Robert Mangile and Kerry Hendricks in 2004 who argues that Penciled is an allele of "Z"locus. If so, then probably Penciled is recessive to "Z +" and dominant or codominant to z*wh. This study is somehow contradicted by the existence of pigeons like Hanna Pouter pencil or Strasser pencil which are Gazzi ("z") pied mark as well Penciled ("pc") as the color distribution in the plume.



Mahrische Strasser pencil (Expo Nitra, Slovakia 2009 // D. Mergeani) (z/z, pc//pc)
Strasser pencil (Expo Nitra, Slovakia 2009 // D. Mergeani) (z/z, pc//pc, S//?)

Also, these study results are apparently contradicted by the existence of pigeons both Tailmark (tail color only) and Penciled (with faded feathers in the tail in a specific gene Penciled effect).



Roller de Pazargic probably homozygous Penciled (Expo Nitra, Slovakia 2009 // D. Mergeani)
Roller de Pazargic probably homozygous Penciled (Expo Iași 2008 // S. Ungureanu)

The first possible explanation for these phenotypes is that penciled is not an allele of the Z locus and a pigeon can be both full color (Z) and penciled as the Botoșani tumblers or both Gazzi (z) and Penciled as Strassers above or both Tailmark (z * tm) and Penciled as Pazargic rollers above.

A second possible explanation for these discrepancies between study results noted above and some “pencil-like” pigeons could be the existence of several types of pencil effect caused by several genes. One of these genes could be an allele of the the locus Z and other genes don't, as can occur similar situations described in the preceding paragraph.

A third possible explanation is that there are some phenotypes similar to those caused by Gazzi or Tailmark gene but that would be produced by the effect (summative or not) of other pied genes, genes that are different than Gazzi respectively Tailmark gene. So a bird could be Penciled and Gazzi-like or Tailmark-like (tail color) phenotype also.

A further possible explanation of the results of the study mentioned above is that gene Penciled would be linked with genes from the locus 'Z', ie with "Z", "z" or "z*wh". This may be one explanation for the existence of Penciled pigeons with bull eyes besides Penciled pigeons with pearl eyes. This feature (bull eyes) is one of the commonalities between action of Pencil gene and action of Recessive white gene.



Botoșani tumbler with pearl eyes (Expo Brașov 2007 // D. Mergeani) (d/?, e/e, pc/pc)
 Botoșani tumbler with bull eyes (Expo Brașov 2007 // D. Mergeani) (e/e, pc/pc)

In this context, it should be noted that the aforementioned study, were used Saxon breast Pencil pigeon, pigeon having bull eyes only (see bellow). This could influence the results of the two American fanciers mentioned above and probably these results could be valid only for the variety of pencil found in this breed.



Saxon breast pigeon with bull eyes (Expo Dortmund, Germania 2008 // D. Mergeani) (S/?, pc/pc)
 Saxon breast pigeon with bull eyes (Expo Dortmund, Germania 2008 // D. Mergeani) (S/?, pc/pc)

The following pictures show a colored head male (homozygous Pencil) and a completely white female with bull eyes (homozygous for Recessive white).



Botoșani tumbler cock homozygous pencil (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) ($e/e, pc/pc$), the father of pigeon below
 Recessive white hen (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) ($z^*wh//z^*wh$), the mother of pigeon below

Pigeon below (obtained from mating pigeons above) have colored or white areas like other pied birds obtained from mating a complete full color with one white. The only difference from these birds is that the colored areas have an effect of Penciled gene.



The offspring of pigeons above (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) ($+//z^*wh, pc/+$ sau pc/pc)

Because his father is homozygous Penciled and the mother is homozygous Recessive White (with no known family tree), if these two genes would be linked and father would be ($Z^{*+}, pc // Z^{*+}, pc$ and the mother would be ($z^*wh, ? // z^*wh, ?$), then all youngs should be ($Z^{*+}, pc // z^*wh, ?$) that is fully colored with or without pencil effect. Therefore, excluding linkage between these two genes, we made two assumptions which are mutually exclusive:

a) The heterozygous state of Penciled gene has, in the presence of the heterozygous state of Recessive white gene, a similar effect with homozygous state of Penciled gene but observable only in some areas of the body. This conclusion does not contradict the allelism between Recessive white and Penciled but do not explain satisfactorily the distribution of colored areas on the body similar to some pied pigeons. It is possible that the occurrence of colored areas are characteristic of heterozygous Pencil heterozygous Recessive white pigeons ($z^*pc//z^*wh$).

b) The pigeon from second picture row inherited from his mother, besides the white recessive gene, some pied genes that contributed to the distribution of colored areas of the body and a Penciled gene too, gene that justifying the effect for the colored areas like homozygous Penciled. Basically, it shows on it's body white areas, colored areas with pencil effect (visible on the tail) and colored areas without visible pencil effect (on the wing shield and head). However, this assumption has a direct implication that the white hen (pigeon mother above) carries both a penciled gene and some dominants or codominants pied markings which has a low probability of occurrence but not impossible.

The cock from the pictures above, paired with a tailmark hen (Baku tumbler) was one of two young tailmark with identical pied marking like it's mother Baku tumbler (see picture right below) and other young has a pied marking similar to his father (probably dominant over tailmark?) but without the pencil colored feathers (see picture left).



The young of the cock above with a Tailmark hen (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) (+?//z*tm, pied)
 The young of the cock above with a Tailmark hen (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) (z*tm//z*wh?)

If the hypothesis of the end of point a) should be true (the male from the top of previous page is z*pc // z*wh), where offspring can only be z*pc // z*tm or z*wh // z*tm. The second variant (z*wh // z*tm) explained the right young phenotype but none of the above clearly does not justify the black areas on the left shoulder young, which are similar to his father's. However, if the baby above the left is heterozygous Tailmark heterozygous Pencil then what distinguishes it from his father (see previous page) which is heterozygous Pencil heterozygous Recessive white, is that it has areas with colored feathers (tail and the back area) fully colored and without pencil effect.

If the hypothesis of point b) should be true and their father is homozygous Penciled, they are heterozygous for this gene and thus no effect Penciled gene phenotype present in the colored areas. As their father is heterozygous for the Recessive white gene then young from right is, with high probability, heterozygous Tailmark heterozygous Recessive white (z*tm // z*wh). The young from left inherited a similar pied marking to his father's. Like all models with fewer white areas, this pied marking is dominant against models with more white areas such as Recessive white and Tailmark. This young is surely heterozygous Tailmark, gene inherited from his mother.

An intermediate phenotype we see at the cock in the picture shown below, pigeon without a known pedigree. As said above about similar phenotype's (colored spots on the shoulder, colored primaries, white spots on the head), this bird should be heterozygous Pencil heterozygous Recessive white. By mating with the hen from the left of the top of this page (probably heterozygous pencil heterozygous Tailmark), resulting offspring were similar to each of them. But what could prove the assumption about their genotype and thus the allelism of Pencil gene with Recessive white or Tailmark genes would be getting, in addition to young with intermediate phenotype, some Pencil or Tailmark young.



Botoșani tumbler (D. Mergeani // D. Mergeani) heterozygous for Pencil but heterozygous for Recessive white, too

By mating the cock above with a white hen heterozygous for recessive white and pencil (see picture right at the bottom of page 6) resulting two white chicks. One of them is white (homozygous Recessive white) and the other is colored head (homozygous Pencil). These results confirm the above assumption on his genotype and his hen too.



Botoșani tumbler (Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) full white, the young of the cock above
 Botoșani tumbler (Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) colored head, the young of the cock above

Comparing the phenotypic appearance of the female below right with the cock from the page no.3 (the last row of pictures) and with the cock from the top of this page, we can assume that the female is also heterozygous for recessive white. With a homozygous Penciled cock she has a few young (see the second row) with incomplete colored head (like cock from page no.3) and with some colored primaries (like the cock from the top of this page)



left- Botoșani tumbler homozygous for Pencil, right – a hen probably heterozygous for Recessive white (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) (e/e, pc/pc), the parents of the hen below
 The same hen probably heterozygous for Recessive white (Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) (z*wh//7z*wh)

Because one of her daughters (see bellow) was still set completely white squabs with one completely white male (homozygous for Recessive white), we can say that the assumption his genotype was correct.

From the pictures above we can conclude that birds heterozygous Pencil heterozygous for Recessive white have the characteristic appearance of white areas in the full color head and small color areas especially in the shoulders and primaries. If we extend this hypothesis to pigeons show to the last page that maize the young from left is heterozygous pencil (suggested by black spots on shoulders and head) but heterozygous tailmark (suggested by fully colored tail) But what is notable, these colored spots have no effect of Recessive white (as full colored) and no Pencil effect, this effect may be similar to Pencil in heterozygous state. White spots on the colored head, it could be due to the effect of pied genes mask or even the effect of Recessive white gene in heterozygous state in a heterozygous Penciled pigeon.

The hen presented below, with a colored head and a few primaries incomplete full color, has her parents show in the photos. His father is homozygous pencil (see picture right) and mother has a phenotype similar to that caused by pencil gene but with two colored primaries and some colored areas on the shield. In conclusion, the hen below is at least heterozygous for Pencil.



Botoșani tumbler hen heterozygous for pencil, heterozygous for recessive white
(Sergiu Ungureanu, Pașcani, Iași // S. Ungureanu) (+//z*wh, pc//?)

This hen, paired with a full white cock with bull eye (homozygous Recessive white) was more completely white youngs with bull eyes and also some with a few colored areas in the head, tail and primaries (see photos below). This suggests that she is heterozygous for Recessive white gene too, which gene is inherited from one of her parents (probably from her mother). Finally, this hen above is at least heterozygous Pencil but heterozygous for Recessive white.



Botoșani tumbler hen heterozygous for pencil, heterozygous for recessive white
(Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) (+//z*wh, pc//?)

Botoșani tumbler hen heterozygous for pencil, heterozygous for recessive white
(Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) (+//z*wh, pc//?)

The cock below, without a known pedigree, looks similar to the female phenotype to the previous page.



Botoșani tumbler cock heterozygous for pencil, heterozigous for recessive white (Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) (+//z*wh, pc//+)

By mating with a completely white hen (homozygous for the recessive white) he had two recessive white young. This confirms that the appearance of this phenotype (pigeon almost entirely white with colored head that has small white areas) is significant for a heterozygous Recessive white heterozygous Pencil pigeon.



Recessive white pigeon, the young of the cock above with a recessive white hen (Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) (+//z*wh, pc//+)

Pigeons like those above (with incomplete colored head) appear in a pigeon mating one heterozygous for Pencil and one heterozygous for Recessive white. Thus, the phenotype of the hen that is seen below, can be considered significant for heterozygous for Pencil heterozygous for Recessive White.



Botoșani tumbler hen heterozygous for pencil, heterozigous for recessive white (Marian Șerbancea, Eforie Sud, Constanța // D. Mergeani) (+//z*wh, pc//+)

Like I said above, we see two somehow stable phenotypes in pigeons supposedly heterozygous for Recessive white and heterozygous for Pencil. The first phenotype is similar with cock from the top of page 5 and with the hen at the bottom of page 5, too. The second is the same with hens from page 6 and that phenotype have much more white areas on the body than the first phenotype. A possible explanation for this difference could be the intervention of some pied genes. These genes could be found in some Botosani tumblers or could be hide for the effect of Recessive white gene at other white Botosani tumblers.

Is notable that all of the mating between recessive white pigeons with pigeons with a pencil effect never produced fully colored birds.

Other examples of intermediate phenotypes at Botosani tumblers we see in pictures bellow. These phenotypes are somehow similar those of Strassers presented in the beginning of this paper. It should be noted that if in an intermediate phenotype could be observed the effects of two genes, not necessarily that these two genes are alleles.



Botoșani tumbler (Sorin Constantinescu, Bârlad, Vaslui // S. Constantinescu) (z/z, pc//pc?)

Botoșani tumbler (Expo Iași 2009 // Sergiu Ungureanu) (z/z, pc//pc?)

Botosani tumblers phenotypes presented above can be explained easily if we take the assumption that Penciled and Recessive white are alleles. This observation suggests that the findings made by Mangile and Kendricks are valid for Penciled variant seen in Saxon breast pigeons and for the Penciled variant found in Botosani tumblers. However, for Penciled variant seen in Strasser presented in the beginning of this paper, more detailed studies are needed.