



GENETICS ON PLUMAGE AND EYE COLOR WITH THEIR PATTERNS IN PIGEONS (AVES: COLUMBIDAE)

ASHRAFUL KABIR

Saidpur Cantonment Public College, Saidpur Cantonment 5311, Nilphamari, Bangladesh

ARTICLE INFORMATION

Article History:

Received: 11th September 2021

Accepted: 13th November 2021

Published online: 21st March 2022

Key words:

Genetics, plumage, eye, color, patterns, pigeons.

ABSTRACT

Bangladesh is full of many fancy pigeons with various colors, but there is a great dearth on the research on color genetics. Most pigeon keepers have some common ideas on these color genetics. They are well-known about blue bar, checker, mealy, and spread black. Several interviews with those pigeon keepers and experiences, a real picture has been come out on this topic. Out of 10 different pairs (blue bar × blue bar; blue bar speckle × blue bar; spread black × spread black; mottle × mottle; multicolored × multicolored; white × brown black; red white patches × red white patches; red × red; yellow × yellow; white × white) on plumage and eye color. The result suggested that same colored (homozygous) parents always produced same colored offspring where white showed epistatic phenomenon. Only heterozygous alleles of the same-colored parents were focused into different colored offspring. White recessive with bull-eyed parents always produced same type of offspring.

1. INTRODUCTION

A. Plumage Colors

There are 40 genera of wild pigeons/doves in the nature. As all fancy pigeons were derived from wild pigeons and their feather colors are same to wild species. For instance, *livia* means gray; *chalk*, *aeneas*, *noenas* is bronze; *phoenikos* is bright red; *badis* is reddish brown; *phapi* is brown; *alectro* is blue; *ptilinopus* is yellow breast; *caloenas* is mixed color, etc. Interestingly, fancy pigeons have no green color reason maybe it needs no camouflage in their loft. Not only the feather color but also leg feather (mainly grouse) and crest are common in wild species. Pigeons are only bird which have sometimes leg feather and sometimes do not. Tail bar is another dominant characteristic of wild or fancy pigeon. Firstly, mutation in wild species and secondly inbreeding and finally selective breeding produced

Table 1. Color history of pigeons

Color	Status of color	Inheritance
Ash red/Red	Basic color	1 st dominant
Blue	Basic color	2 nd dominant
Brown	Basic color	3 rd dominant
Yellow	Dilute red	1 st dilute dominant
Ice/Silver	Dilute blue	2 nd dilute dominant
Gray	Dull silver	Recessive
Black	Spread blue	Epistatic/Recessive
Dun	Dilute black	Black and dun co-dominant
Khaki	Dilute brown	3 rd dilute dominant
Chocolate	Spread brown	Dominant on yellow
White/milky white	Absence of color in feather	Epistatic/Recessive
Albino	Absence of pigment in entire body	Recessive

Source: (Link), (Link)

*Corresponding Author: ashraful.mission@gmail.com

Copyright 2017 University of Sindh Journal of Animal Sciences

lots of fancy pigeons of the world. White color was common in nature but for selection and for different environment and food domestic or fancy pigeons have achieved white then albino (lack of melanin pigment in entire body) formed. White is recessive and albino is an epistatic characteristic of pigeon given in Table 1.

Table 2. Color/pattern with genetic expression

Pattern/Color	Expression
T-check	Top dominant/1 st dominant
Dark check	2 nd dominant
Light check	3 rd dominant
Blue bar	4 th dominant
Mealy bar	5 th dominant
Lace	T-check × toy stencil
Grizzle/Tortoise	Whole body grizzled
Almond/Sprinkle	Epistatic
Splash	Look like Rock Pigeon
Mottle	Head is grizzled basically
Andalusian	This is the mixing of spread and indigo
Speckle	Like the small spots of <i>Columba guinea</i> on the wing
Pencil	Edge of the wing and tail is blackish

Source: (Link), (Link)

Table 3. Study of genetics in fancy pigeons

Incidents	Example
Incomplete dominance	Grizzle/Tortoise
Co-dominance	Grizzle, almond, indigo, heterozygous opal, semi-lethal
Lethal (pleiotropies)	Homozygous dominant opal
Semi-lethal	Dominant opal
Pleiotropism	Dominant opal
Dominant	Spread, red > blue > brown
Recessive	White
Epistasis	Wild type, spread blue, recessive red, recessive white, almond, albino is epistatic to dominant opal, dilute and brown is epistatic to recessive opal
Hypostasis	Modena bronze
Top dominant	T-pattern
Autosomal recessive	Gazzi
Atavism	Blue and bar in fancy breeds

Source: (Link), (Link)

B. Eye colors

Orange and White (Pearl) Eye

According to W. F. Hollander the orange eye is the iris color of *Columba livia* and most of the feral pigeons. Orange colored eyes are formed by the presence of pteridine pigments and for lacking this we find white or pearl eyes. Some breeds like tumblers, cumulates, nuns, never have orange eyes unless they were crossed with other breeds.

Bull Eyes

In bald-headed, badge marked, beard marked, saddle, magpie, bell-necked, ring-necked, pencil, gazzi, white flights, and white tails have bull eyes (black eyes). When no pteridine and guanidine pigment is manufactured, then we can see the black pigment in the inner surface of the iris, and this is how we get the bull eyes. Pied variety is caused by lack of pigment cells at the white locations. Bull eyed birds are simply birds which have the normal black pupil like all pigeons have, but their iris color is also look black even though when look closely. Bull eye is epistatic to wild type (orange color). All recessive white pigeons have bull eyes. In pigeons we still get pigment cells that migrate to the inner parts of the eye and those pigment cells make black pigment just fine (Cryberg, 2006). The granular phaeomelamines produce the colors of the red group; the rod shaped eumelamines produce those of the black group (Levi, 1945). Bull eye is, therefore, characterized by the absolute lack of any pigment upon the anterior surface of the iris (Muller & Schrag, 1985).

Pink Eyes

There is also a pink looking eye found in albino pigeons. Albinism is a mutation that eliminates pigment production altogether. Gene of the pink eyes is epistatic to all eye colors.

Odd Eyes/Split Eyes

When the color of the both eyes is different this is called odd or split eyes. Odd eyes would be the two sides of the head are not perfectly symmetrical.

Cracked Eyes

It seems that perhaps the pigment cell migration is slightly different between those going to the eyes. The migration of the cells being different that goes to the eye and those going to feathers theory can also explain the cracked eye phenomenon in pigeons.

Other Eye Colors

New mutations happen all the time and the science has not explained or not enough research has been done on other eye colors yet like green and brown eyes.

The objective of this study is to observe the plumage and eye color of the pair of pigeons and the result of their offspring.

2. MATERIALS AND METHODS

English Tippler

English Tippler pigeons are available in Bangladesh. Its color variation is remarkable. In mottled variety, its feathers on the head region are dark in color. White feathers are the base color of this pigeon. This white color is an epistatic characteristic so offspring will be mottled with many whites.

Turkish Tumbler

In fact, its base color is black at all.

Crossbreds

It is variable in colors. Normally crosses between or among various tumblers. For the genetic study, these types of pigeons are good in many cases but complicated to understand their purity.

Lotan

Mostly white in color but for mutations some other colors like red, patches, and dark checker have produced.

Gola (local)

Many breeders cross this with Lahore, tumbler, and lotan so that they get variable colors in their offspring.

Bombai

Basic colors are Red and yellow, but very few are whites and blacks.

Selective Breeding

For this experiment above pigeons were reared separately so the plumage and eye color of their offspring showed real output. Basically, pigeons are gregarious and when they get chance males try to mate with other females. These experimental pairs were caged for a long time or carefully handled until the desired result will come. (Kabir, 2015) published a report based on Bangladesh that pigeon breeders do many crosses for achieving various colorful pigeons in their loft.

Video

A very effective video from the YouTube helped a lot for understanding many colors and their inheritance (Link).

3. RESULTS AND DISCUSSION

Pearl eyed pigeons were very common in tumbler group of Bangladesh. In fact, the plumage color is somehow depended on the males. Homozygous mottled parents always produce same type of offspring. In contrast, heterozygotes produce different colored squabs. White colored recessive lotan pigeons (though this is milky white) with bull eyes always produce same type of offspring like other tumblers. As white is an epistatic gene so if any pigeon carries this gene of course their squabs will get somehow some white feathers are given Table 1, 2, and 3.

Table 4. Plumage and eye colors with their patterns of the pigeons

Male	Female	Eye color	Plumage of squab	Eye color of squab	Comments
Blue bar (BB)	Blue bar (BB)	Pearl	Blue bar	Pearl	Homozygous parents
Blue bar speckle (BS)	Blue bar (BB)	Pearl	50% both blue bar speckle and blue bar	Pearl	Male was heterozygous
Spread black (SbSb)	Spread black (SbSb)	Male was yellow, Female was pearl	Spread black	Pearl	Pearl is dominant over yellow
Mottle (Mo)	Mottle (Mo)	Pearl	1. Mottle 2. Blue bar 3. White and Black (light print)	Pearl	Both are heterozygous mottle; white is epistatic
Multicolored (McMc)	Multicolored (McMc)	Male was yellow, Female was bull	Multicolored	Bull	For the epistasis of the white plumage, eyes were bull
White (ww)	Brown and Black (BrBl)	Bull	Chestnut brown	Bull	White is recessive
Red-white patches with very few black spots	Red-white patches with very few black spots (RW)	Bull	1. Red-white patches 2. Self red 3. Self white 4. Dark	Bull	Both were heterozygous; black gene spreads

(RW)			checker		
Self-red (RR)	Self-red (RR)	Yellow	Self-red	Self-red	Homozygous parents
Yellow (yy)	Yellow (yy)	Yellow	Yellow	Yellow	Homozygous parents
White (ww)	White (ww)	Bull	White	Bull	Both were homozygous white, and eyes were bull

Mo=Mottle; RW=Red white; BS=Blue speckle;
 BB=Blue bar; w=White; Br=Brown; Bl=Black;
 Sb=Spread black; y=Yellow; R=Red;
 Mc=Multicolored

Pigeons have a glorious past among other birds. Within its genes lots of mutations which is one kind of mistake creates many differences. This is unknown that barb, jacobin, and antwerp are rarely found in blue (Chapman, 1911). Only 5% genes are in males ZZ chromosome where female carries this only on W chromosome. Feather color of pigeons are controlled by multiple alleles likewise other animals. Mutations are found in pigeons' eye color too. Wild Rock Pigeon has orange eye and it is the 1st mutated color was found pearl in tumbler pigeon. Thousands of crossing were maintained in pigeon after domestication and showed very peculiar or extraordinary color variants and very pronounced are almond, qualmond, grizzle, and indigo etc. Epistatic genes are very common in pigeon so that multicolored pigeons are available all over the world. Spread blue, recessive red, almond, albino, dilute, and brown etc. all are suppressed another loci gene. Dominant opal, though it is lethal, it has pleiotropic (multiple) effect. Sooty color of pigeon is basically a dirty color affects ash red and produces strawberry color. From smoky, it is possible to express grizzle. In pigeon, its white is not real white, in fact this is milky white, and it is resembled with ice which is actually powdered silver. White rumps in all varieties, especially are a decided fault. Thus white is in reality the absence of all color pigments it is nonetheless the most important to the pigeon fancier (Chapman, 1911). Indigo color is very rare in pigeon and for its co-dominant tendency it forms andalusian. Black is a modifier or called spread, for its dominance it has various patterns. Black color is found in almost every variety of pigeons, also especially in the marked varieties. Decided faults, except in the marked variety are light colored beaks or toe nails (Chapman, 1911). Black must be bred to black if you wish a long lived strain, which will continually improve. While dun cannot be called an acquired color such as silver, it is without doubt complementary black (Chapman, 1911). Black is dominant to blue (Levi, 1945). The color of yellow is

faulty if it is only a surface color, for it should extend way to the skin (Chapman, 1911). Yellow is the dilute of either dominant or recessive red. Barred yellow are known as cream (Levi, 1945). Bronze color is only found in Modena breed. This bronze color is a hypostatic gene. T-pattern (dark checker) is a top dominant characteristic in pigeon but sometimes this pattern looks very dark and is considered as velvet. Laced wings are mostly common in oriental frill group. Sometimes for epistatic activities of those genes, we find some confusing-colored breeds. Pale and dilute are basically alternative words.

4. CONCLUSION

Pigeons are very colorful birds in the avian kingdom. It has many more colors due to thousands of selective breeding. Tumbler pigeons are more diversified in the world. In this case, Bangladesh is not an exception. Many rearers are keeping various quality pigeons. They know about the inheritance of plumage and eye color of pigeons. In fact, they make pair their pigeons with the same-colored bird. Very few cases after anyone missing of the pair for the short time, they sometimes make pair with other pigeons. Based on the color genetics these pigeons are excellent at all.

5. CONFLICT OF INTEREST

The author has declared that there is no conflict of interest regarding the publication of this article.

REFERENCES

- Muller, E., Schrag, L. (1985). *Fancy Pigeons: A Handbook of the History, Care and Breeding of Exhibition Pigeons with Illustrations of 229 Breeds*, Schober Verlags-GMBH, pp. 252.
- Cryberg, R. (2006). Biosynthesis of eumelanin and pheomelanin. <http://mangile-pigeons.sperrygalligar.com/Biosynthesis%20of%20Eumelanin%20and%20Pheomelanin.html>
- Chapman, E.R.B. (1911). *Color Breeding for the Pigeon Fancier*. Introduction copyright 2016 by Jackson Chambers, pp. 48.
- Kabir, M.A. (2015). Selective breeding of pigeons in Bangladesh. *J. of Advanced Studies in Agricultural, Biological and Environmental Sciences*, vol. 2, no. 2, pp. 1-6.

Levi, W.M. (1945). The Pigeon, R.L. Bryan Company, Columbia, S. C., pp. 512.

Links:

<https://mumtazticloft.com/PigeonGenetics4.asp>

<http://www.angelfire.com/ga/huntleyloft/Page1.html>

https://www.youtube.com/watch?v=ui73nJqiw_o

<https://mangile-pigeons.sperry-galligar.com/GeneSymb.html>