MATHEWS

Review Article

Mathews Journal of Veterinary Science

Hereditary Divergence in Pigeons

Ashraful Kabir*, Tania Zaman

Department of Biology, Cantonment Public School and College, Saidpur Cantonment—5311, Nilphamari, Bangladesh

ABSTRACT

As an accessible bird, the pigeon could be perfect for observing many deviations of genetics. Bangladesh is full of many colorful pigeons where genomic incidents are common. Pigeon breeders, pet shop, and pigeon market of Bangladesh possesses many colorful pigeons. In addition, personal experiences and oral history helped a lot to understand genetic incidents as a whole. Sometimes, few colors were confusing but online materials clarified those queries. The results suggested ten genetic phenomena after Mendel caused by natural and artificial breeding. These findings suggest further studies as adequate viable pairs to prove deviations with their ratio to step forward of Mendel's Law of Inheritance.

Keywords: Incomplete Dominance, Co-Dominance, Lethal Gene, Epistasis, Complementary Gene, Supplementary Gene, Polygene, Multiple Allele, Atavism, Pleiotropism, Pigeons.

INTRODUCTION

Albino and white pigeons are common in fancy pigeons of Bangladesh [1]. Through selective breeding, pigeon keepers get many colors and shape-size of the crest of pigeons [2,3]. The genes of egg-laying and the size of birds are the example of polygenes [4]. Wild type head is dominant over the head-crest of pigeons. In fact, most of the pigeon keepers cross their pigeons haphazardly, do not think on the ratio of male and female, crested and wild-type, and colors. In the field of Genetics, for explaining the deviation of Mendel's law, pigeons can be an outstanding bird. Anatomical studies focus on the various lengths of pigeons' beaks [5]. There is a scope to study the lethality of pigeons for reducing their embryonic death. This work may help for keeping a good idea of the multiple alleles of pigeons. Epistatic actions and co-dominance give us many unbelievable colors and patterns in pigeons. The pleiotropic effect causes harm to pigeons in lethality. Homozygous lethal shows embryonic mortality, whereas heterozygous condition acts on death at early ages of birds. Incomplete dominance is nothing but faded or dilute status to the deep color of one parent. The supportive genes affect the colors and patterns of pigeons (white shield of wings). Phenotypic studies of pigeons easily could explain those genomic incidents, and indeed uncountable selective breeding was the raw material in this field. There are few references to the effects of different mutations and epistatic relationships among loci that contribute to complex traits. Centuries of artificial selection in domestic rock-pigeons (*Columba livia*) have cultivated tremendous variation in plumage color; pigmentation through

Vol No: 09, Issue: 03

Received Date: February 25, 2025

Published Date: March 07, 2025

***Corresponding Author**

Ashraful Kabir,

Department of Biology, Cantonment Public School and College, Saidpur Cantonment—5311, Nilphamari, Bangladesh, Phone: +88-01712563750;

E-mail: ashraful.mission@gmail.com

Citation: Kabir A, et al. (2025). Hereditary Divergence in Pigeons. Mathews J Vet Sci. 9(3):68.

combined effects of dozens of loci [6]. The objective of this study is to understand some phenotypic deviations of pigeons after Mendel's Law of Inheritance.

COLORS, PATTERNS AS WELL AS MUTATIONS IN PIGEONS

Incomplete dominance: There are at least four different factors which produce white plumage in pigeons and are inherited independently. Homozygous condition produces a practically self-white and heterozygous expresses nearly white birds. In heterozygous birds there are often some white feathers, showing incomplete dominance of self-color [7].

Co-dominance: Grizzle mutation in pigeons would be a good example of co-dominance. Ninety percent (90%) recessive is generally called simply recessive whereas 90% dominant is called dominant. Thus, everything in between should be considered as co-dominant that will help to understand the argument better between dominant, recessive, and co-dominant genes. In pigeons, grizzle, almond, indigo, and dominant opal is fair example of co-dominant genes [8].

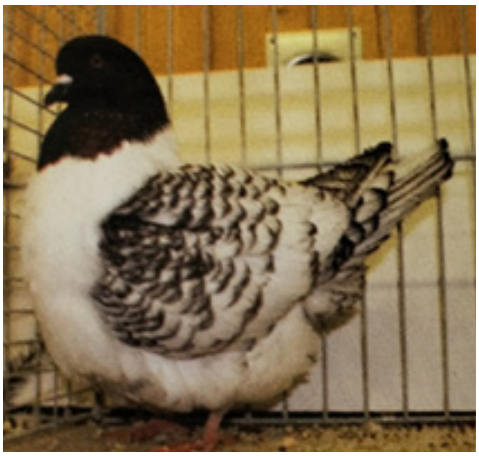
Lethal genes: If death is caused just before the reproductive stage, they are called sub-lethal genes. Dominant and recessive lethal genes are conditional lethal genes, semi-lethal or sub-lethal genes, and synthetic lethal genes. Homozygous dominant opal, homozygous webbed toes are lethal; other homozygous web-traits are harmless. Most of the times the death caused by web-lethal mutation will happen at hatching. There is another lethal gene found in pigeons called 'achondroplasia' also known as dwarfism, which is a skeletal disorder, characterized by failure of normal conversion of cartilage into bone [9]. Polydactyly is lethal, none survived up to maturity. Pigeon eggs have twins in them, but they are simply not able to hatch. Webbed toes fail to hatch or fail to live over 10 days [10]. Polydactyly of pigeons are categorized in four groups [11]. Breeding data suggest that homozygous dominant opal is usually lethal. The few suspected homozygous dominant opals that lived showed near white phenotype, and they had abnormal feathers and were short lived. Again, dominant opal mutation clearly shows second distinct phenotype depending on its heterozygous versus homozygous (lethal) state, it is also a co-dominant mutation [8].

Dominant epistasis: When a dominant allele of one gene hides the expression of all alleles of another gene is known as dominant epistasis. For instance, gene of albinism is dominant and hides the expression of the pigment in the eyes, skin, and hair. In the case of pigeons, spread is said to be epistatic to all known patterns. Homozygous red, white-side, and wild-type are also epistatic to the white wing of the gimpel-pigeon [8].

Recessive epistasis (complementary gene) and pleiotropism: Recessive white and albino is also epistatic gene [8]. Albinism is a pleotropic trait where the gene for this trait not only results in the typical albino deficiency of skin, feather, and eye pigmentation, but also causes defects in vision. Creamy white (false pearl) eyes are another example of pleiotropism. Dilute, recessive white, almond, recessive red are pleiotropic genes [8]. Dominant opal (Od) is a pleiotropy in pigeons, dominant in respect to coloration and recessive in respect to vigor [12].

Supplementary gene: Supplementary genes are genes that both contribute to a single characteristic, and one gene can mask the effect of the other. Alternatively, supplementary genes in terms of one gene expresses a characteristic and the second one only acts as a 'supplement'. White sides on recessive red and white wing on ash-red called supplementary mutations [8].

Multiple allele: When different types of genes are located on the same locus (allelic genes) is known as multiple alleles. Gazzi and pencil could be expressed side by side in one individual in many breeds [12]. Gazzi, pencil, tail-mark, and plumage colors are depended on the multiple alleles [13]. There are triple alleles (on the same locus) in ringneck doves—white, blond, and dark (wild-type) [14]. This series was later found to tie with the d (dilute) series in pigeons [15]. In pigeons, sex-linked ash-red, wild-type, and brown factors multiple alleles were first reported by Hawkins (1930) at the University of Wisconsin [16]. Another multiple-allelic series are bar (wild-type), T-pattern, dark checker, checker, light checker, and barless [17].



Polygene: A polygene is a member of a group of non-epistatic genes that interact additively to influence a phenotypic trait. When different types of genes are located on the different locus (non-allelic genes) is known as polygene. The length of beak of various pigeons depends on the polygenes. Many pigeon breeds in the world are found with different size of beaks [18].

Atavism: In Biological, the recurrence of traits of an ancestor in a subsequent generation is known as atavism. It is very common to express blue plumage and bar pattern on the wings of fanciest breeds [19,20]. Many results in blue bar progeny with homozygous different colors are mentionable in this atavism or reversion [21] (Table 1).

Table 1. Genetic phenomena in pigeons

Incidents	Examples
Incomplete dominance	Some white feathers of the self-color; grizzle/tortoise
Co-dominance	Grizzle; black-dun; almond; indigo; heterozygous opal; semi-lethal
Lethal gene	Dominant opal; webbed toes
Pleiotropism (semi-lethal)	Albinism; false pearl eyes; homozygous dominant opal; recessive red
Dominant epistasis/Epistasis in dominant state	Dominant white; white; milky white; almond; sprinkle; wild-type; spread blue; albino is epistatic to dominant opal
Recessive epistasis/Epistasis in recessive state/Complementary gene	Recessive white; recessive red
Supplementary gene	White sides and white wings
Multiple allele	Pattern and base colors; dilution, pale and wild-type
Polygene	Beak length
Atavism/Penetrance/Expressivity	Blue and bar in fancy pigeons; extra toes; feathered feet; webbed feet

Source: [8,19,20]

CONCLUSIONS

Pigeons have diversified colors from the very beginning when it used to keep in selective breeding. Sufficient genetic observations could find out more genomic incidents with their ratio. This write-up suggests to do practical study on the plumage color of pigeons with identifying the exact cause of these incidents. This type of study could flourish the chapter 'Deviation of Mendel's Law'.

ACKNOWLEDGMENTS

None.

CONFLICT OF INTEREST

The authors declare that they have no financial interests or personal relationships that could have influenced this work.

REFERENCES

1. Kabir MA. (2014). White-feathered domesticated fancy pigeons of Bangladesh. Science Inventions Today. 3(4):322-329.
2. Kabir MA. (2015a). Head-leg feathers in fancy pigeons of Bangladesh. American Research Journal of Bio Sciences. 1(1):48-51.
3. Kabir MA. (2015b). Selective breeding of pigeons in Bangladesh. Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences. 2(2):1-6.
4. Islam MS. (2018). Selected Lectures on Genetics. Lambert Academic Publishing, Germany. 300 pp.

5. Grouw KV. (2018). Unnatural Selection. Princeton University Press. 304 pp.

6. Domyan ET, Guernsey MW, Kronenberg Z, Krishnan S, Boissy RE, Vickrey AI, et al. (2014). Epistatic and combinatorial effects of pigmentary gene mutations in the domestic pigeon. Curr Biol. 24(4):459-464.

7. Walker JR. (1925). Inheritance of White Plumage in Pigeons. Genetics. 10(6):593-604.

8. https://mumtazticloft.com/PigeonGenetics1.asp

9. Hollander WF. (1945). Lethal achondroplasia in the pigeons. Journal of Heredity. 36(10):297-300.

10. Hollander WF, Miller WJ. (1982). A new sex-liked mutation, web-lethal from racing homers. American Racing Pigeon News.

11. Hollander WF, Levi WM. (1942). Polydactyly, a sub-lethal character in the pigeon. Journal of Heredity. 33(11):385-391.

12. Sell A. (2012). Pigeon Genetics. Sell Publishing, Achim, Potsdamer Street. 528 pp.

13. Hollander WF. (2002). Multiple Alleles. In: Pigeon Genetics News, Views & Comments. pp. 21-22.

14. Cole LJ. (1930). A study of hybrid doves. Aviculture. 2:27-30.

15. Cole LJ, Hollander WF. (1950). Hybrids of pigeon by ring dove. The American Naturalist. 84(817):275-307.

16. Hollander WF. (1983). Origins and Excursions in Pigeon Genetics. The Ink Spot. 148 pp.

17. Hollander WF. (1937). Hereditary interrelationships of certain factors in pigeons. Thesis, University of Wisconsin.

18. https://www.biorxiv.org/content/10.1101/2021.03.15.435542v1.full

19. https://mumtazticloft.com/PigeonGenetics4.asp

20. https://www.angelfire.com/ga/huntleyloft/Page1.html

21. Hollander WF. (1994). Origins and Excursions in Pigeon Genetics. Foy's Pigeon Supplies, Golden Valley, MN. 148 pp.