



The Pigeon Genetics Newsletter

News, Views, and Comments.

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Section # (1) Beginner

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Report on the primary investigation on the colour of Lalband-Ghagra

First of all, I would like to thank Mr. Bob Rodgers for encouraging and helping me to get a pair of Lalband-Ghagra in order to investigate the genetic variations responsible for the colour of these birds. Of course, I have had his help up to date from the start and we have had discussions on colour of each and every cross that we produced as part of the investigation. He did not want me to mention his name in the report, but we all know the fact that credit should be given where it is due. We both worked at this, not just me. It will have been two years in June of 2016, since we started test breeding the Lalbands.

ABSTRACT

A number of experts around the world have thought that the genetic mutation/s responsible for the colour of Lalbands are pale and Indigo, some others have thought that they could be faded or frosty plus something else, similar to the causative mutations for the colour of thuringer self pigeons or Basara dewlaps, relating to the sexual dimorphic character of Lalband-Ghagra. Some have suggested that the colour of the bars on Lalbands is similar to the colour of bars present in some Modenas. Are any of these ideas really responsible for the colour of Lalbands or any mutation/s for that matter that we already have discovered? From the sexual dimorphic character and uniqueness in the colouration, it was certain that something new that we were hitherto unaware of is present in them. From the intense purple sheen around the neck of adult cock birds, we were fairly sure that they are intense and no pale factor is present in them. In order to find out these things, we decide to do breeding tests, in individual pens, evaluating the colour of crosses as babies, in the juvenile plumage and as adults. Our test breeding results provided insight into the genetic basis of the colour of Lalbands. We found that Lalbands posses the wild type allele (intense) on the sex-linked dilution locus. We also discovered a sex-linked, partial dominant mutation. The mutation is somewhat variable, females are hemizygous and males are homozygous for the mutation in the pure Lalband breeding strain. Heterozygous cocks were very similar to hemizygous hens in the F1 and F2 generations. In the F2 generation, additionally we got homozygous cocks with colour almost similar to the colour of Ghagra (males) from the pure Lalband breeding strain to colour similar to that of dirty ash red, suggesting that the expression of the mutation is fairly variable. This ancient, but newly discovered mutation has been given the name "Saffron" and the symbol "Saf". We also found a bronze that expresses on the pattern in the non saffron F1 hens. This bronze shows very weak to a somewhat stronger expression on heterozygous hens in the juvenile plumage and is considerably reduced in the expression after the juvenile molt. We also found another mutation, that expresses similarly but not identical to under grizzle. It seems to be undesirable on Lalbands and was carried unnecessarily by the birds which we tested. We are uncertain of the location of the Saffron mutation in the sex-linked chromosome, but when considering some scientific points, comparing the colour of crosses with the phenotypes produced by other known mutations present on the sex-linked chromosome, we hypothesize that the so called Base locus or Major pigment locus where Ash red and Brown mutations are present is a possible candidate. Whatever

it is, the clues or points in front of us would not prove anything, a very detailed analysis is certainly needed in order to find out the genetic location of Saffron.

INTRODUCTION

Lalband-Ghagra (or abbreviated as Lalband) is an ancient Indian breed, relatively not much is known outside of India and Pakistan. According to some well experienced old fanciers, the breed is believed to have 'originated' during the Mughal Empire, in the seventeenth century, in Delhi. However, there is no existing written record to our knowledge and thus the breed might be even older than the hearsay belief. The breed is similar to wild ferals in shape, size, etc but has an unique colour.

Lalband-Ghagra is well known for its sexually dimorphic colour, in fact birds from the pure Lalband breeding strain should be sexually dimorphic. Cocks are known as Ghagra (meaning grayish), similar colour to Ash red (without tail band), but has a very faint bluish tint all over, Their head is grayish blue coloured similar to the head colour of Wild ferals and they usually develop an intense purple sheen around the neck, which is usually not evident in the juvenile plumage. Some adult cocks do lack the purple sheen or some come without the desired depth of purple sheen or some come with over reddish-purple sheen covering the head. Hens are called Lalband (meaning red bar). They have a striking, somewhat glistening blue colour, and show a tail band that is usually somewhat faint and thinner. Unlike the name, 'Lalband' indicates that their bars should be a yellowish orange colour. These things are generally preferred in the breed, however, we don't have a written standard for the breed yet and thus a number of other colour varieties are present in the breed and they are all generally known as Lalband. Birds in some of the strains are not sexually dimorphic, and some of those strains might have been created by crossing with other breeds.

In June 2014, we managed to get a pair of decent quality birds with sexually dimorphic colour, from a breeder in Tamil Nadu. After a few months we bought a dilute Lalband hen from a different source, she is also from a breeding strain of

birds which shows a different colour linked to gender. Dilute hens sometimes pop up in the breeding pen of Lalband-Ghagra and are attractive. I have also seen dilute Ghagra cocks and the dilute versions are also sexually dimorphic. Fanciers from the northern part of India call the dilute version ‘Zara band’. Our primary aim was to figure out the genetic basis behind the unique, sexually dimorphic, colouration of Lalband-Ghagra.

Below are photos of the birds used in the test breeding program.



Ghagra (cock)



Lalband (hen)



Dilute version of Lalband(hen)

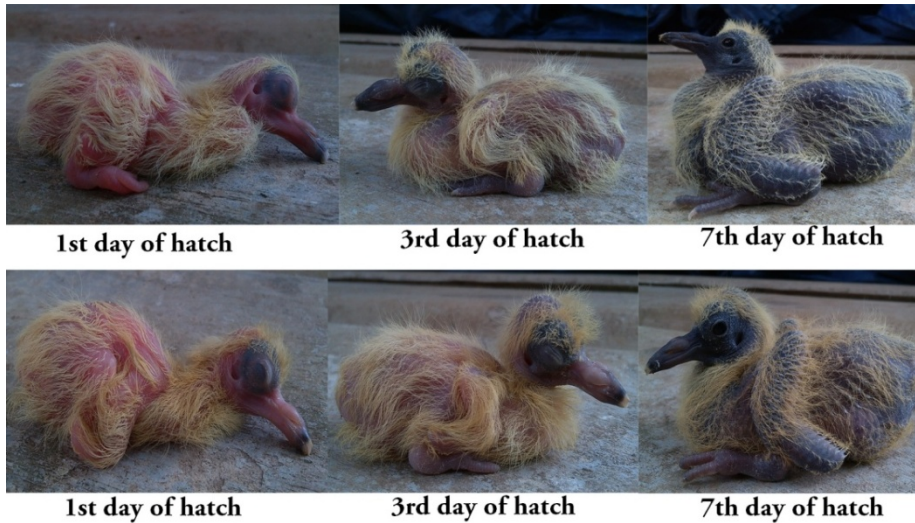
Method used: Traditional Mendalian test breeding method.

Protocols: We mainly used racing homers to out cross the Lalbands. All the pairing and breeding was done in individual breeding pens. In order to be certain of the correct parentage, we removed the first two rounds of eggs from every pairing done as part of the test breeding. We out crossed the cock and hens with unrelated birds (mainly homers), mated the F1s together, out crossed and back crossed the F1s, and analyzed the phenotype of all the progeny. Data was summarized using tables.

RESULTS

The Ghagra was mated with the Lalband hen and has produced seven offspring; three of them were males and four were females. He was also paired

with the dilute Lalband hen and produced a couple of youngsters; a male and a female. All the daughters were similar to the Lalband hen and all the sons were similar to the Ghagra cock. All the progeny were dark skinned in the nest that is because of Dirty factor. Except one youngster, all had dark feet and beak in the nest, the one with light beak and feet in the nest got a horn coloured beak as an adult, she was also smokey.



Above, in the first and second row a male and a female baby in 1st, 3rd and 7th day of hatch respectively. In the photos below are nestmates(both are females) bred from the Ghagra cock and Lalband hen.



Juvenile plumage

Adult plumage

1) Out crossing of Ghagra cock

The Ghagra cock was mated to three unrelated hens and produced nine offspring in both sexes. Except for one spread youngster, all had reddish bars, somewhat lighter flights compared to that of wild type specimens, and thinner to near normal tail band. None of the offspring got the colour of the sire (Ghagra), all were somewhat similar to Lalband hens, however, in contrast the overall colour tone of all youngsters was darker. We could not find any difference in down length or colour tone of skin, beak or feet as babies. All had dark skin and feet indicating that dirty was present. Some youngsters were dusty blue in the juvenile plumage and molted the dusty tone, which is typical when dirty is present.



Right a male baby in three and five days old respectively and left a female baby in three and five days old respectively (both are nest mates) below are photos of them in the adult plumage.



Cock



Hen

Above photos are examples for F1 cock and hen from the outcrossing of Ghagra. As you can see their colour is exactly the same, indicating that no pale factor is present. In both photos their primary feathers are slightly more faded than normal due to sunlight(42 C temperature).

Sire	Dam	Clutches	Colour	Gender
Ghagra (cock)	Dirty sooty blue bar	1st Clutch	Blue with reddish bar	Male
			Blue with reddish bar	Female
		2nd Clutch	Blue with reddish bar plus sooty	Male
			Blue with reddish bar	Female
	Het spread blue bar	1st Clutch	Blue with reddish bar	Male
			Infertile	
		2nd Clutch	Black with faint reddish tint on bar	Male
			Blue with reddish bar	Female
	Blue check carrying bar	1st Clutch	Blue with reddish bar	Not confirmed
			Blue with reddish bar	Not confirmed

2) Out crossing of Lalband hen

The Lalband hen was paired with two unrelated cocks and produced a number of offspring in both sexes. All the sons were similar coloured to the offspring produced by the Ghagra cock x homer, additionally some of them had a whitish base of the primaries and tail feathers similar to the expression of Under grizzle, whereas, all the daughters were blue with black bars showing faint bronzing on the bars, the bronze moulted out partially. This results suggested that the sexual dimorphic colouration of Lalband-Ghagra is probably caused by a dominant sex-linked mutation.



Two cocks out of the Lalband hen out-crossing; first one with flights and tail feathers similar to Ug, however, the pattern was not affected by the mutation. Second one is without it .



A blue bar hen before and after the moult respectively. It would be hard to see the bronzing from the photos, but it was clearly visible in real life.



Another cock showing partially whitish primaries

Dam	Sire	Clutches	Colour	Gender
Lalband hen	Ashred check, dirty,sooty carrying blue	1st Clutch	Blue with reddish bar, sooty,whitish flights and tail si milar to Ug.	Male
			Infertile	
		2nd Clutch	Blue with reddish check,sooty, whiti -sh flights and tail similar to Ug	Male
			Infertile	
	Blue bar	1st Clutch	Blue with reddish bar	Male
			Blue with reddish bar	Male
		2nd Clutch	Blue with black bar showing faint bronzing	Female
			Blue with black bar showing faint bronzing	Female
		3rd Clutch	Blue with reddish bar, base of prima ries were whitish.	Male
			Blue with black bar showing faint bronzing on bar	Female

3) Out crossing of the dilute lalband hen

The dilute Lalband hen was paired with two unrelated cocks and produced a number of offspring. All blue birds with reddish bar were males, all the blues with black pattern were females and they had a bronze on their pattern, which moulted out partially. We also got some ash red out of an Ashred racer X dilute lalband mating, unfortunately all of them were females.

Dam	Sire	Clutches	Colour	Gender
Dilute lalband hen	Blue bar	1st Clutch	Blue with black bar showing faint bronze	Female
			Blue with black bar showing faint bronze	Female
		2nd Clutch	Blue with reddish bar	Male
			Blue with black bar showing faint bronze	Female
	Ash red check, sooty, carrying blue	1st Clutch	Blue black check with bronze on pattern	Female
			Infertile	
		2nd Clutch	Blue black check showing bronze on pattern	Female
			Ash red bar sooty	Female
		3rd Clutch	Blue with reddish bar, sooty	Male
			Ash red bar, sooty	Female
4th Clutch	Blue with reddish bar	Male		
	Ash red check, sooty	Female		



Three photos of F1 blue checks showing some bronzing on the pattern; first two photos are of a blue check in the juvenile and in the middle of the juvenile plumage respectively. The bird in the third photo is also in the middle of the juvenile plumage. As you can see the amount of bronze is reduced in the adult plumage. Both are hens.



From left to right an ashred bar sooty, ash red check sooty and a blue with red bar sooty. First two are hens and the last one is a cock.

4) F1 cock with red bar X F1 hen with red bar

We paired up F1s with red bars to see if they can produce phenotype similar to Ghagra cock. The result is given below.

A) Pairing 1

Both cock and hen are bred from the Ghagra cock X a dark blue bar hen (birds shown on page 6)

Sire	Dam	Clutches	Colour	Gender
F1 cock; blue with reddish bar	F1 hen; blue with reddish bar	1st Clutch	Blue bar	Female
			Similar to Ghagra (cock) but bars were darker (reddish)	Male
		2nd Clutch	Blue with reddish bar	Female
			Blue with golden yellowish bar similar to that of Lalbands	Male
		3rd Clutch	Dark blue bar	Female
			Ash red look-alike	Male
		4th Clutch	Ash red Look-alike	Male
			Similar to Ghagra (cock)	Not Confirmed
		5th Clutch	Similar to a dark ashred bar carrying recessive red	Male
			Infertile	

B) Pairing 2 (An F1 blue cock with red bar bred from Lalband hen out-crossing X Blue hen with red bred from Ghagra out-crossing)



Cock

Hen

Sire	Dam	Clutches	Colour	Gender
F1 blue with red bar	F1 blue with red bar	1st Clutch	Blue with reddish bar	Female
			Infertile	
		2nd Clutch	Blue bar showing faint bronze on bar	Female
			A phenotye exactly similar to Ghagra (cock)	Male
		3rd Clutch	Blue with reddish bar	Male
			Blue bar showing faint bronze on bar	Female
		4th Clutch	Blue with reddish bar	Female
			Blue with reddish bar	Female
		5th Clutch	Blue with black bar	Female
			Blue with reddish bar	Male

Below are some of the F2s from the above two F1 x F1 mating



Female



Male



Female



Male



Male

5) F1 cock (Blue with reddish bar, sooty, whitish base of primaries and tail) X An unrelated dark blue bar pied hen

Sire	Dam	Clutches	Colour	Gender
F1 (Lalband x homer) Blue with reddish bar, sooty	Dark blue bar pied	1st Clutch	Blue bar pied	Female
			Infertile	
		2nd Clutch	Dark blue with reddish bar	Female
			Dark blue with reddish bar, sooty	Female
		3rd Clutch	Blue with reddish bar plus sooty	Male
			Blue bar with some bronze on the pattern	Male
		4th Clutch	Blue with reddish bar	Not confirmed
			Infertile	



The parents

Female

Female

Male

Male

6) F1(Ghagra x Black homer) X dilute Lalband hen



Cock; photos in juvenile and adult plumage

Hen

Sire	Dam	Clutches	Colour	Gender
F1(Black with some reddish tint on the bar) bred out of Ghagra X black homer	Dilute Lalband hen	1st Clutch	Similar to spread ashred with some yellowish orange pigmentation on bar	Male
			Black	Female
		2nd Clutch	Black	Female
			light blue with somewhat brownish bar	Male

Below are youngsters from the above pairing



Male

Female

Male

DISCUSSION

We have produced nine F1s out of the Ghagra(cock) mated to three unrelated hens and produced four males and three females and the remaining two died before maturity. Except for a spread cock, all were blue with reddish bars and had black tail bands. The Lalband hen and dilute Lalband hen when mated with two unrelated cocks produced nineteen F1s; eight of them were males and the remaining were females. All males were blue coloured with the bar/check colour red and two of them had base of primaries and tail feathers whitish similar to the expression of under grizzle. All females (except three Ash reds) were blue bar/check with a faint bronzing on the pattern that was more visible on checker than barred. The expression of bronze was considerably reduced with the juvenile molt. All the blue F1s with reddish bars had flight feathers a little bit lighter than wild type specimens. The initial breeding results clearly show that there is a sex-linked, dominant mutation involved which is responsible for the reddish bar and lighter flights. From the similarity in the intensity of colour of the male and female F1s, we concluded that they are intense and pale factor is not involved. The result is summarized in the table given below.

parent	Number of crosses produced				Gender
	Ash red	Blue bar or check	Blue with reddish bar or check	Black	
Ghagra cock				One	Male
			Eight		4 Males 2 Females 2 not confir
Lalband hen			five		All males
		Three			All females
Dilute Lalband hen			Three		All males
		Five			All females
	Three				All females

We hypothesized that the Ghagra cocks would be homozygous for the sex-linked mutation, which is what makes them similar to ash red colour and the bronze found on the blue bar/check F1 hens could be responsible for the desired colour (yellowish orange) of bars in pure Lalband-Ghagra. In order to find out these things, we mated F1s together, and we got some young Ash red look-alikes, some were very similar to Ghagra, and they all were males. A cock that is heterozygous for the sex-linked, dominant mutation had the colour of the bars (also flights) desired in the Lalband-Ghagra breed. It may also be homozygous for the bronze mutation, but the rest of the plumage was darker compared to pure Lalband hens. We are uncertain as to what is responsible for the desired light bluish colour tone on hens and 'bluish' ashy colour tone of Ghagra cocks. With the limited number of F2s we can't make a conclusion on that; however, the sex-linked dominant mutation seems to be variable, so probably it will be affected by unknown modifiers which we can't explore by test breeding. The intense reddish-purple on the neck of adult cocks is caused by the Saffron mutation, which is usually less pronounced on hemizygous hens (something similar to wild type Columbia livia;

where the purple sheen on the neck of adult hens is less pronounced in contrast with that of the adult cocks). The one Lalband hen expressing the smoky mutation developed a fair amount of the reddish-purple sheen with the juvenile moult. That was not a surprise as smoky usually has a tendency to enhance the reddish tone on the neck in many cases. We are still working on the under-grizzle look-alike mutation, so not disclosing much about it in this report.

Below is a table with summarized data of F1 x F1 mating

Colour of F2s (F1 x F1)	Total No	Gender		
		Male	Female	Unsexed
Blue with or without faint bronze on bar	5		5	
Blue with reddish bar	6	2	4	
Blue with yellowish orange bar	1	1		
Ash red look-alike or gha gra phenotype	6	5		1

Naming of the Sex-linked mutation

Heterozygous and hemizygous F1 birds were similar in colour; blue with reddish bars. Homozygous cocks are ash red look-alike with or without a faint bluish tone. The phenotype produced by this mutation especially in the Lalbands is similar to the colour of the Saffron flower (a flower with light blue petals and yellow to red stigmas that is a highly expensive spice used as seasoning and a coloring agent), and the bar colour of Lalband is similar to the colour of the upper band of the National flag of India, the colour is known as deep saffron. So considering these facts and the origin of the breed, thus probably the mutation, we decided to give the name "Saffron" symbol "Saf" for the newly discovered sex-linked, partial dominant mutation, in honor of the Country. Of course, as an Indian I am really proud to give that name.



Saffron flowers and its Stigma



A Lalband(hen) and a Ghagra (cock in juvenile and adult plumage) respectively.

Saffron in combination with spread

One of the F1s out of the Ghagra x spread (black) racer hen mating was a spread heterozygous saffron cock. The spread racer dam was a dull black which is not an uncommon phenotype in racing homers. The colour of the son was similar, but he had some reddish tone on the pattern (that may be difficult to see from this photo). The son was backcrossed with Lalband and one of the youngsters from that mating was similar to spread ash red, and had some yellowish orange colour on the barred area, but lacked the purple sheen on the neck. These crosses proved that the mutation produces sexually dimorphic colorations in combination with spread too.



Spread racer hen



Spread het saffron son



Spread homo saffron (cock)

Definitely we have no real data as to where the Saffron mutation is present on the sex-linked chromosome. However, from the colour of the crosses (both with and without spread) and from the mode of Inheritance of the mutation, it MAY BE an allele of Ash red. We know that it is not the first mutation discovered in pigeons that are look-alikes of ash red, cherry and Indigo are very familiar to us in this matter and neither are allele of Ash red. But the mode of inheritance of the mutation is also suggesting that it may be an allele of Ash red.

According to the research report “Epistatic and Combinatorial Effects of Pigmentary Gene Mutations in the Domestic Pigeon” published by the U of U, the location of the BA mutation is at the highly conserved cleavage site of the signal peptide of Tyrp1 gene and this results in dramatic reduction in the cleavage efficiency of the gene. And their analyses suggests a model in which BA is a neomorphic allele that alters processing of the mutant TYRP1 protein within the cell, providing insight into the molecular basis of dominance of the BA allele. Neo-morphic alleles are always dominant or partial dominant.

Not only at the cleavage site, but a mutation that happens beyond the cleavage site of a gene can also alter the cleavage efficiency. So such a possibility is there in the case of the Saffron mutation, especially since it's a partial dominant mutation.

We considered not suggesting the possibility of an Allelic relationship with Ash red, but even if this turns out not to be the case, we felt it would do no harm to postulate, given the above information.

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