

The Pigeon Genetics Newsletter

News, Views, and Comments.

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July 2015 Volume 7, page 1.

Section # (1) Beginner.

Stipper

Stipper, which is referred to as almond in many breeds is one of the mutations studied by ancients. In 1925 Christie and Wriedt named the mutation "Stipper" and symbolized it as St. It is a Sex-linked, incomplete dominant mutation. Birds homozygous/hemizygous for the presumptive ancestral or wild type allele are normally pigmented. Birds heterozygous/hemizygous for the mutation are usually short downed in the nest and are very light (can even be completely white) to a few dark pigmented areas in the juvenile plumage and becoming darker as they age. If bronze is present then they can be reddish with a few flecks in nest, apparently stipper doesn't affect bronze a lot. Heterozygous males darken faster than hemizygous females; sometimes males that are heterozygous for the mutation can become normally pigmented in just 4 to 6 years, whereas many heterozygous cocks can still show some non-pigmented areas even after 6 or 7 years of age.

Hemizygous females are very slow in the darkening process and are usually lighter than heterozygous stipper cocks with the same age. Het/hemi stippers normally don't have any kind of health issues. It has been noted by breeders that het/hemi stippers usually take more time than wild type to start the eye pigmentation.

Photos above, from left to right heterozygous stipper blue bar (German beauty homer) by Mick Bassett, a group of classic almonds (English short-faced tumbler) bred by James Ellison, and a heterozygous stipper ashred T-pattern (Indian fantail) breeder unknown.

The bird in the collage is a heterozygous stipper on a wild type specimen (old cock) belonging to Kleurpostduiven Kloosterhaar.

As you can see in the photos above the effect caused by this mutation in het/hemizygous form is one of multiple spotting or flecking of colour. That is caused by the Stipper mutation blocking the pigmentation and causing some of the area to become white in an irregular distribution within each feather and as a result throughout the entire bird's covering. This effect of whitish and colored areas is referred to collectively as "break" by pigeon enthusiasts.

The suppression of pigementation by the stipper mutation begins to fail over the bird's life and a "Reversion" back to the normal pigmentation takes place gradually. Therefore the darker they are after the first molt, the darker they will be as time goes on until 4 to 8 years of age. At that time a stipper blue bar may end up looking like a Blue Tiger grizzle or Mottle Pied or maybe even a normal blue bar.

At left a normal downed (wild type) baby from my own loft, in the middle a het/hemizygous stipper baby with naked skin bred by Bruce Coons out of a stipper cock and non stipper hen. And the third one is head view of a stipper baby showing short down bred out of a stipper cock mated to non-stipper hen by Ismail Haji.

Homozygous stipper

Homozygous stipper is semi-lethal. Homozygous stipper cocks are of course naked in the nest and are mainly white in juvenile and can show some pigmentation in adult plumage and/or after many years. I have seen a few homozygous stipper adult cocks and they had some pigmentation on the head and neck area and/or the shield. Because of the lethal problems , most of them die before hatching or in the nest, birds which survive exhibit deafness and ocular problems (microphthalmia, abnormal iris and or blindness); consequently, most guidelines recommend against breeding stipper to stipper and the true breeding strain is not fixed in any breed.

A homozygous stipper adult cock with abnormal iris bred by Kenny Davis. And at right is a wild type eye.

Heterozygous stipper spread blue (Racing homer) bred by Jijo Thomas.

The phenotype is known as Grey stipper in Danish tumblers and Sprinkled in Oriental rollers. Usually they start out lighter with a few black flecks and get darker as the age progresses. In 7 or 8 years of age the pigmentation can be completely normal and then they can look similar to pepper headed (spread heterozygous classic grizzle) with or without some white spots on the shield and/or other areas.

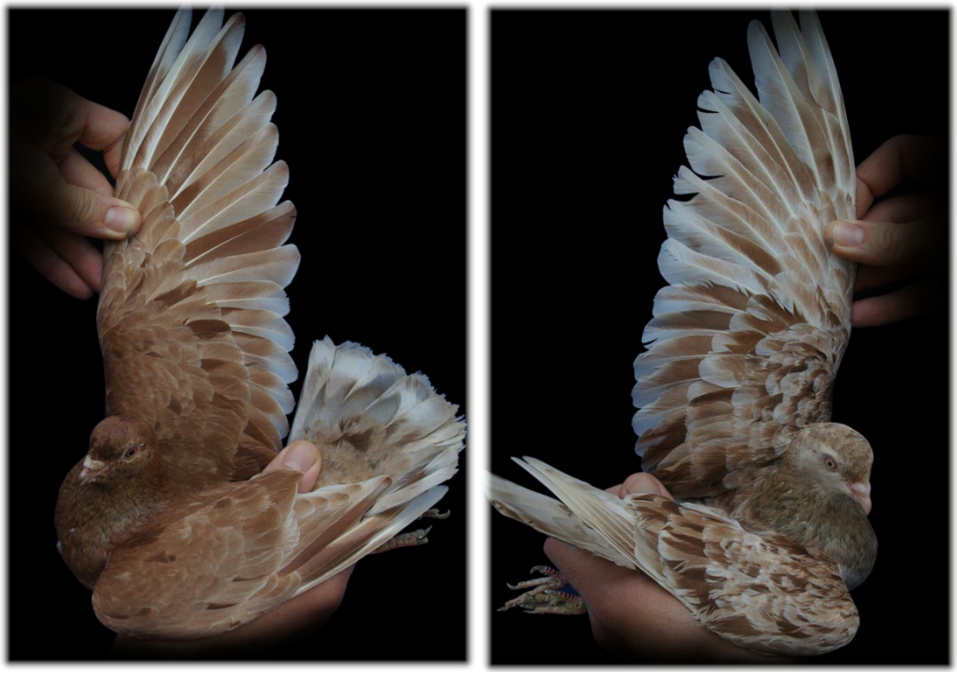
Stipper on Ashred and Brown base

A four years old stipper ashred T pattern (Racing homer) owned by Jijo Thomas.

Some stipper ash-reds in juvenile and younger age are usually a bit lighter in colour tone than normal ash reds. Stipper ash-red T-patterns with or without light bronze are very attractive. With heavy bronze the amount of white can be almost nil especially on T-patterns, and may look similar to an ash-yellow colour tone without any break.

Stipper ash-red bar hen (Saint Pigeon) Showing black flecks bred by Steve Shaw.

Not all ash-red stippers, (talking about homo/hemizygous ash-reds, not ash-reds carrying blue), show black flecks however it is not that uncommon. By the way stipper hens are lighter compared to heterozygous cocks and stipper blue bronze hens with a few black flecks sometimes can be mistaken as the case mentioned above by inexperienced breeders.



A couple of Italian modenas, at left a Stipper ash-red T-pattern with bronze and at right a Stipper brown T-pattern hen…photos from Fabio Zambon..Breeder Antonio Vaccari. Most of the Stipper browns I had seen were also spread, the stipper brown T-pattern is one of the rarest phenotypes I have seen.

Gazzi marked stipper spread brown looks like a hen, photo from Fabio Zambon.

Left a dilute stipper spread brown hen, at middle an intense heterozygous stipper spread brown cock and at right is a stipper blue heterozygous brown (stipper linked to blue) cock. Photos from Fabio Zambon.

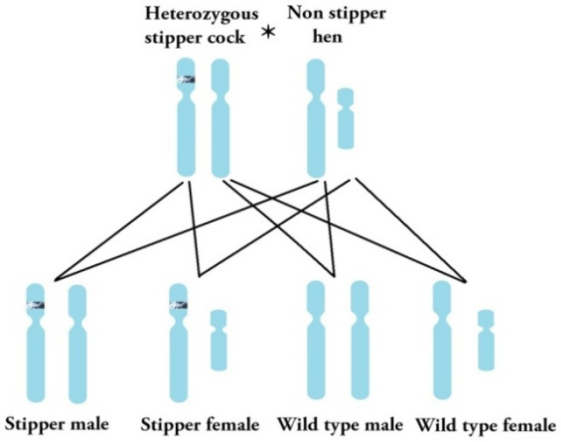
A yearling stipper blue T-pattern carrying brown (stipper linked to blue) (heterozygous recessive red?) Indian fantail bred by Dan Skiles Jr.

Notice the tail band, it is a non-spread. If it was a spread then the light reddish tone due to het recessive red or kite over the shield, neck and head would be lacking as spread suppresses the expression of heterozygous recessive red and/or kite.

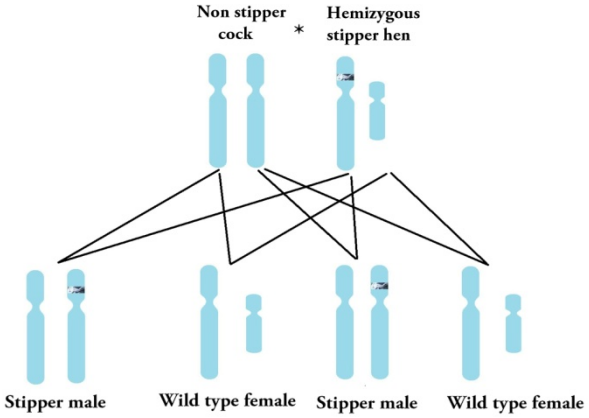
Section # (2) Intermediates:

Calculation using the Chromosome diagram.

Since homozygous stipper is semi-lethal to the individual and producing birds with health issues is against humanity, mating of stipper to stipper is not recommended. Stipper dominates the wild type allele, and it is a sex-linked mutation, so heterozygous cocks and hemizygous hens would always show the expression and that is what we need to get in all of the show type phenotypes of stipper (in combination with other non-allelic mutation/s) like classic almond, grey stippers, brown stipper, yellow stipper, sprenkle etc. Since homozygous cocks are mostly white, that is not even worth trying at all.



Mating of heterozygous stipper cock to wild type hen produces 25% heterozygous sons, 25% non stipper sons, 25% hemizygous stipper daughters and 25% non stipper daughters.

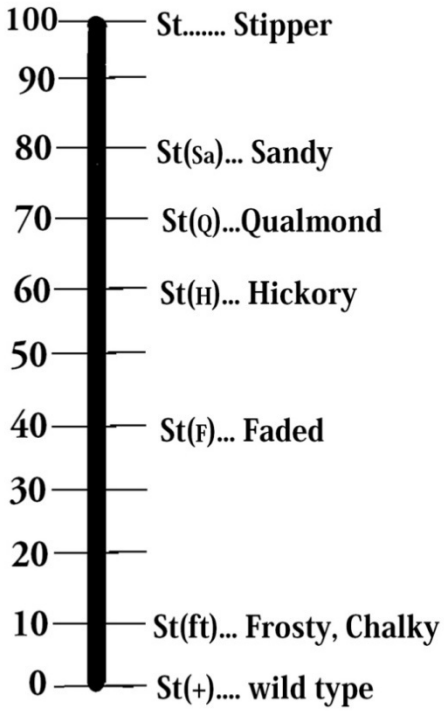


Mating of wild type cock to Stipper hen is a sex-linked mating. There are only two possibilities for this mating; heterozygous stipper sons and wild type daughters.

Other alleles at the Stipper locus.

Stipper locus is one of the loci that mutated many times in Columba livia. Including stipper there are seven mutations known to happen at the stipper locus and most (if not all?) are present in various domestic breeds. The other alleles at the stipper locus are Sandy, Qualmond, Hickory, Faded, Frosty and Chalky.

Doc Hollander studied the mutants and arranged them based on the extent of depigmentation each of them can cause.



Above is the same scale of St-alleles drawn by me with the information present in the original diagram by Hollander that someone posted in a face book group few years back.

Stipper heterozygous qualmond males

Like homozygous stipper cocks, stipper heterozygous qualmond males are naked in the nest and are much lighter in juvenile. However, unlike homozygous stippers, stipper heterozygous qualmond is not semi lethal to the individual and they usually don't exhibit any abnormalities but usually take much more time to start outer eye pigmentation, until then their eyes will be dark.. Over the years their plumage can get darker. Like stipper hetero qualmond cocks, stipper heterozygous faded cocks are also very light in the juvenile and usually don't exhibit any abnormalities.

A couple of stipper heterozygous qualmond spread blue (Russian tumblers) bred by Mike Walter Sr. Left two are in juvenile and right two are of the same birds after three years. Both are nest mates, however interesting to notice one is much darker than the other one. The dark one has colored eyes and the other one still has dark eyes.

We will have another Issue devoted to the alleles of stipper later on.

Stipper in combination with some other non-allelic mutations.

Heterozygous stipper blue T-pattern heterozygous tiger grizzle cock. Unfortunately I forgot the breeder name.

Heterozygous stipper spread blue heterozygous indigo(stipper andalusian) racing homer, three years old bred by Octavian Sarafolean and a Stipper blue T-pattern heterozygous Indigo young Russian tumbler bred by Steve Shaw.

Volume 7; Page 12.

At left dilute stipper ash-red carrying blue Indian fantail in juvenile bred by Dan Skiles Jr. and at right dilute stipper blue young hen bred by David Sandhoff.

At left a heterozygous stipper blue bar (Ts1) bronze and at right a blue bar (Ts1) bronze (Italian modenas)... Screen shot from a you tube video by Fabio Zambon.

Sometimes even heterozygous stipper cocks can be lighter or even look white. Below two such young cocks bred out of a smoky spread ash-red bar cock mated to stipper spread blue homozygous bar (or check het bar hen) by Axel Sell.

Parents with second clutch youngsters again two whites.

The young cocks are almost at the end of juvenile molt. They are possibly heterozygous stipper smoky spread ash-red heterozygous blue homozygous bar with (stipper linked to blue).

Young cocks from the first clutch, one of them has a spot of black on neck.

Some phenotypes similar to but not stipper.

Almond babies. Spread ashred baby. Spread blue homozygous indigo.
First two by Willi, second from fb and next two owned by Imran.

All three genotypes can show variable phenotypes depending on the presence or absence of other mutations. However they can look similar in certain genetic combination as exemplified above. Almond babies change a lot with each molt. Spread ash-red babies don't show much colour change. Most of the time Spread blue homozygous indigo babies show dark head unlike pictured above, and they molt out the reddish coloration with bluish colour.

Above we have a heterozygous stipper spread blue Danish tumbler by Wim Halsema. & Homozygous faded spread blue Texan from the internet.

Above: Stipper spread blue bar (Ts1) Italian Modena by Fabio Zambon and a dilute ash-red het blue Lahore from fb group.

A couple of neat blue bar heterozygous tiger grizzles , first one is a modena from group and second a Giant Homer bred by Tibor Kalauz.

These can be mistaken as stipper blue bars. However, tiger grizzle depigments the affected feathers completely unlike stipper that cuts off pigment from a portion of the feathers. And tiger on blue doesn't affect tail and flight feathers whereas it invariably will on Stipper specimens.

A dilute ashred heterozygous classic grizzle Fantail bred by GaryBoomershine and an intense hemi stipper ash-red hen bred by Mike Walter Sr.

Almond look-alike Afghan musafir pigeon.

A similar almond look-alike is also present in shield marked Bavarian Highflyers, in which only cocks show the dark flecks and they are creamy unlike the afghan musafir. They normally have down in the nest. We don't have much background info about the afghan breed.

Brown and yellow stipper Danish tumblers

Unlike the name indicates this brown stipper and its dilute version yellow stipper are blue based. The bronze present in them is similar to kite and related to brander bronze, but not the full brander. However, I have seen photos of some old brown stipper Danish tumblers with black flights and tail and the rest of the plumage was indeed very reddish with only few flecks here and there. They looked like stipper with full brander bronze to me. Unfortunately, no photos of them.

Brander bronze was thought to be an improved Kite with other modifiers, but some past testing indicated that it was indeed a separate type of bronze with kite as a partner.

Yellow and brown Danish tumblers photos by Wim Halsema.

Here we have a breeding result from Wim's first attempt to recreat brown stippers. He has extracted a kite bronze look-alike phenotype from his brander bronze Danish tumblers. And he mated the bird with a grey stipper (spread black) cock and produced a spread stipper cock with decent amount of bronze on head to shield. We know that spread suppresses the expression of kite and produces somewhat grayish ground colour when present in classic almond unlike the spread stipper with bronze expression that Wim produced. This indicates the Kite look-alike bronze extracted from brander is similar to kite, but not identical.

Kite look-alike hen and its son (spread stipper bronze) bred by Wim Halsema.

Classic almond

Almond coloration is one of the attractive phenotypes present in domestic pigeon breeds such as English short-faced tumbler, Limerick tumbler, Portuguese tumbler, oriental rollers etc. Recently the coloration was introduced in to many breeds like Indian fantails, Racing homers etc. However, the coloration in the newly introduced breeds often lacks rich ground colour or almond birds with rich ground colour are rare in them compared to the breeds from which the colour originated.

Couple of almond English short-faced tumblers bred by Pavel (Pvl lofts). Bird on top is a hen and one below is a cock with balanced colour, both are four years old.

As the name Indicates almond birds have "Almond nut" coloured feathers which compose its ground tint. Almond birds should have very rich almond ground colour with irregular dark flecks. And distinct black, white and ground coloured areas should be present on their flight and tail feathers.

Three Almond cocks, from left to right two, three, and four years old. First one owned by (Pavel) Pvl lofts, and the second and third birds owned by James Ellison.

Almond cocks are heterozygous stipper and are darker than hemizygous stipper hens.Tri-colour(distinct white, black and almond ground colour) on tail is required, but it is difficult to maintain on cocks. Most loose the white on tail after three years and get a tail similar to that of kites. During each molt, darker feathers grow in. Some cocks are not showable anymore after four years of age. In 6 to 7 years Eumelanogenesis (black pigmentation) can be completely normal and the birds may look like kite.

Two or three year old almond hen bred by James Ellison. And a juvenile almond bred by Pavel (Pvl lofts), seems to be a hen.

Almond hens are lighter than almond cocks and they maintain their colour longer.

Almond breeding rules

Classic almonds are blue based, heterozygous/hemizygous stipper. Dark T-pattern is required for the maximum dark flecks. Homozygous kite and heterozygous recessive red gives rich almond/amber ground colour. Stipper mutation slightly lightens bronze and that's how the ground colour is almond coloured instead of normal reddish tone that we see when kite expresses without stipper. The Genotype of Classic almond can be symbolized as;

Cock: (St//+) ; (B//B) ; (CD//CD) ; (K//K) ; (e//+)

Hen: (St//.) ; (B//.) ; (CD//CD) ; (K//K) ; (e//+)

Since stipper and recessive red are required in heterozygous state for the almond coloration, it is not possible to fix a true almond breeding strain and we have to follow certain breeding rules in order to breed maximum number of classic

almonds. Otherwise, eventually we may loose quality of the almond coloration. Other than almond,.. Kite, Agate and Deroy are used and produced in the classic almond breeding programs

Kite

Kites are blue T-pattern with a partial dominant bronze factor called kite. They can be heterozygous for recessive red.

At left tail and wing spread of a kite heterozygous recessive red English short-faced tumbler bred by Pavel (Pvl lofts) and at right wing spread of a kite without carrying recessive red ESFT often called "dark kite" (not a good photo). Breeder unknown.

Genotype of kite can be symbolized as;

Cock: (B//B) ; (CD//CD) ; (K//K) Hen: (B//.) ; (CD//CD) ; (K//K)

Kites come in various shades of reddish tone. From dark blue with a little bronze only on base of primaries to very reddish primaries with or without bronze on head, neck and chest. Kites that are heterozygous for recessive red are usually more bronze than a kite without recessive red. And their primaries are more

reddish than dark kites. In pure almond breeding strains, such as ESFTs , all kites are supposed to be homozygous kites and we know that heterozygous recessive red affects the reddish tone on kites, however I'm not sure what is responsible for the more and less reddish tone of kites that are het for recessive red.

Agate

Agates are Blue T-pattern homozygous recessive reds with kite bronze that are used and produced in the almond breeding program. They are usually selfs in juvenile and after the juvenile molt some white feathers molt in on shield and/or on rump and/or on head. Sometimes very little white only, where as some look almost Whiteside.

Three agates with various amounts of white on them. First two bred by James Ellison and the last one bred by Rob Mast.

Genotype of agate can be symbolized as;

Cock: (B//B) ; (CD//CD) ; (K//K) ; (e//e) Hen: (B//.) ; (CD//CD) ; (K//K) ; (e//e)

If all agates are just kite recessive reds, then whats responsible for the variation of the amount of white? I suppose it is the same factor/s that gives some kites rich reddish tone!

Most of the recessive reds that are not from almond breeding programs are also spread and may lack kite. Out crossing almonds to such reds produce spread almonds or almonds with less ground colour. Spread suppresses the expression of kite and heterozygous recessive red and the birds usually lack ground colour.

Deroy

The term "Deroy" originally came from English short-faced tumblers. They are het/hemizygous stipper recessive red. All deroys from almond breeding strains are supposed to be T-pattern kite as well.

Genotype of deroy can be symbolized as;

Cock: (St//+) ; (CD//CD) ; (K//K) ; (e//e)

Hen: (St//.) ; (CD//CD) ; (K//K) ; (e//e)

An eight year old Deroy hen by James Ellison and a Deroy photographed by Layne Gardner...does not appear to be that old.

Deroys are light reddish coloured or colour in between red and yellow and dark red flecks develop as their age progresses. Sometimes inexperienced breeders can mistake young deroys for dark yellow. Like kite and agate, deroys are also useful in the almond breeding program.

Different pairings and their outcomes

Matings of subvarities

Parents		Offspring												
		Kites				Agate (Kite homozygous recred		Het/hemizygous almonds						Homozygous stipper (only males)
Sire	Dam	Kite lacking het rec red		Kite plus het recessive red				Almond lacking het recred		Classic almond		Deroy(Recred Stipper)		
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Kite lacking recred	Kite lacking recred	8/16	8/16											
kite het recred	Kite lacking recred	4/16	4/16	4/16	4/16									
Kite lacking recred	kite het recred	4/16	4/16	4/16	4/16									
kite het recred	kite het recred	2/16	2/16	4/16	4/16	2/16	2/16							
kite lacking recred	Agate			8/16	8/16									
Agate	kite lacking recred			8/16	8/16									
Kite het recred	Agate			4/16	4/16	4/16	4/16							
Agate	Kite het recred			4/16	4/16	4/16	4/16							
Agate	Agate					8/16	8/16							

As you can see in the table, mating non-stippers together, otherwise present in any almond breeding program, results in non-stippers and we would not get any almonds or deroys from such matings.

Stipper to non-stipper matings and vice versa.

There is a main point to remember when breeding classic almonds, and that is, dark kites and almonds with less ground colour usually lack heterozygous recessive reds. So dark kites should be mated to deroy or almond with good ground colour and almonds with less ground colour should be mated to deep kite

or agate with lots of white(atleast any agate)….This is not exactly applicable to breeds to which almond colouration newly introduced as they may also lacking good kite bronze which ofcourse affect ground colour of almonds.

Parents		Offspring												
		Kites				Agate (Kite homozygous recred		Het/hemizygous almonds						Homozygous stipper
Sire	Dam	Kite lacking het rec red		Kite plus het recessive red				Almond lacking het recred		Classic almond		Deroy(Recred Stipper)		
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	(only males)
kite lacking het recred	Almond lacking recred		8/16					8/16						
Almond lacking recrd	Kite lacking het recred	4/16	4/16					4/16	4/16					
Kite het recred	Almond lacking recred		4/16		4/16			4/16		4/16				
Almond lacking recred	Kite het recred	2/16	2/16	2/16	2/16			2/16	2/16	2/16	2/16			
Agate	Almond lacking recred				8/16					8/16				
Almond lacking recred	Agate			4/16	4/16					4/16	4/16			
Kite lacking recred	Classic almond		4/16		4/16			4/16		4/16				
Classic almond	Kite lacking recred	2/16	2/16	2/16	2/16			2/16	2/16	2/16	2/16			
Kite het recred	Classic almond		2/16		4/16		2/16	2/16		4/16		2/16		
Classic almond	Kite het recred	1/16	1/16	2/16	2/16	1/16	1/16	1/16	1/16	2/16	2/16	1/16	1/16	
Agate	Classic almond				4/16		4/16			4/16		4/16		
Classic almond	Agate			2/16	2/16	2/16	2/16			2/16	2/16	2/16	2/16	
Kite lacking het recred	Deroy				8/16					8/16				
Deroy	Kite lacking het recred			4/16	4/16					4/16	4/16			
Kite het recred	Deroy				4/16		4/16			4/16		4/16		
Deroy	Kite het recred			2/16	2/16	2/16	2/16			2/16	2/16	2/16	2/16	
Agate	Deroy						8/16					8/16		
Deroy	Agate					4/16	4/16					4/16	4/16	

Table of various almond pairings and their outcomes.

Out of the 18 pairings the four given in the table below possibly yields maximum classic almonds (chance for about 50% offspring with classic almond coloration.

Agate	Almond lack -ing recred				8/16					8/16				
Almond lac king recred	Agate			4/16	4/16					4/16	4/16			
Kite lacking het recred	Deroy				8/16					8/16				
Deroy	Kite lacking het recred			4/16	4/16					4/16	4/16			

Stipper-Stipper mating

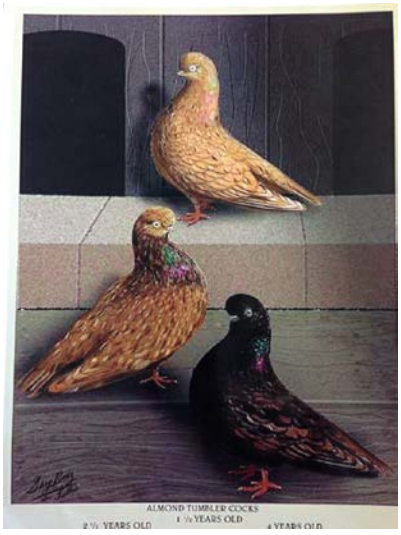
Parents		Offspring												
		Kites				Agate (Kite homozygous recred		Het/hemizygous almonds						Homozygous stipper
Sire	Dam	Kite lacking het rec red		Kite plus het recessive red				Almond lacki- ng het recred		Classic almond		Deroy(Recred Stipper)		
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	(only males)
Almond lac king recred	Almond lack ing recred		4/16					4/16	4/16					4/16
Almond lac king recred	Classic almond		2/16		2/16			2/16	2/16	2/16	2/16			4/16
Classic almond	Almond lack ing recred		2/16		2/16			2/16	2/16	2/16	2/16			4/16
Classic almond	Classic almond		1/16		2/16		1/16	1/16	1/16	2/16	2/16	1/16	1/16	4/16
Almond lac king recred	Deroy				4/16					4/16	4/16			4/16
Deroy	Almond lack ing recred				4/16					4/16	4/16			4/16
Classic almond	Deroy				2/16		2/16			2/16	2/16	2/16	2/16	4/16
Deroy	Classic almond				2/16		2/16			2/16	2/16	2/16	2/16	4/16
Deroy	Deroy						4/16					4/16	4/16	4/16

The table is just to show possibilities, stipper – stipper mating is not recommended as there are always ¼ th chance for homozygous stipper cocks, which can die in egg or after hatch or may survive with abnormalities.

Volume 7; Page 27.

According to what I have heard from the ESFT breeders, dilutes rarely pop up in the breeding pens. Mating them with non-dilute yields all intense offspring, at least half of the offspring will be intense when dilute hens are mated with cocks carrying dilution.

Four English short-faced tumblers. From left to right a dilute kite often called Golden "Dun" in the breed, a dilute classic almond cock (three years old), a dilute agate and a dilute deroy young hen. First, second and fourth by James Ellison and third one by James mullan.



Three photos taken from Fulton's book. First is one of the Fulton colour plates showing Almond Splash, Deroy, Red Agate and Kite a colour mix to breed Almonds. Second one showing darkening of typical classic almond ESFTcocks from the ageing process, from top to bottom one and half years old, two and half years old and four years old.

On the third photo, feather on top is a primary of yellow agate, feather on extreme left and feather on extreme right showing primaries with tri-colour required for standard classic almond cock and hen respectively. Feather on extreme bottom is primary of kite and one just above is a tail father of almond called as "splash tail or pied tail", according to what I have heard such pied tail is described for standard classic almond ESFTs, but it is hard to get on almonds. At middle top from left to right tail feather of classic almond cock in juvenile, after first molt, after second molt and after third molt respectively. At middle down from left to right, tail feather of classic almond hen in juvenile, after first molt and after second molt respectively...Photos collected from a face book group.

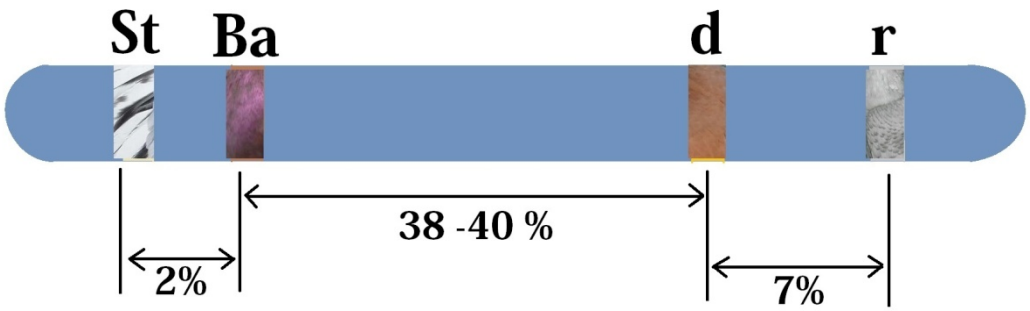
Almond on bar pattern

From left to right Racer owned by Willi, Indian breed Rektha, breeder unknown and a Portuguese tumbler by Perdo J Bento.

Almond on bar pattern shows less ground colour and flecks compared to almond on T-pattern.

Section # (3) Advanced:

Crossing over rate between stipper and other sex-linked loci.



Z – Chromosome

So far we know that eight-plus loci mutated in the sex-linked chromosome, however cross over rate between only a few of them have been established. According to some past breeding results, the cross over rate between stipper and ash-red loci is found to be about 2%, and between ash-red and dilute loci found to be about 38 to 40% (between stipper and dilute could be about 38 to 40 +/- 2%) and between dilute and reduced about 7% (between stipper and reduced loci could be about 40 – 47%).

I have seen sometimes people applying cross over rate as chance for getting a particular genotype. For example, a stipper blue cock carrying brown (stipper linked to blue) mated to brown hen. In this case, we know that cross over rate between stipper and brown is about two percentage, so people apply the same percentage as getting pure brown stipper cocks or hens from that pairing (that is 2%), but that is not correct. From that pairing we can get two percentage crossover type offspring and they can be either stipper brown or non stipper blues. So chance for getting stipper browns is only 1% (that is half of the cross over rate between the loci). It is same for a particular cross over type offspring from any two loci, (chances are always about half of the cross over rate).

Heterochromatin depended silencing or Position effect

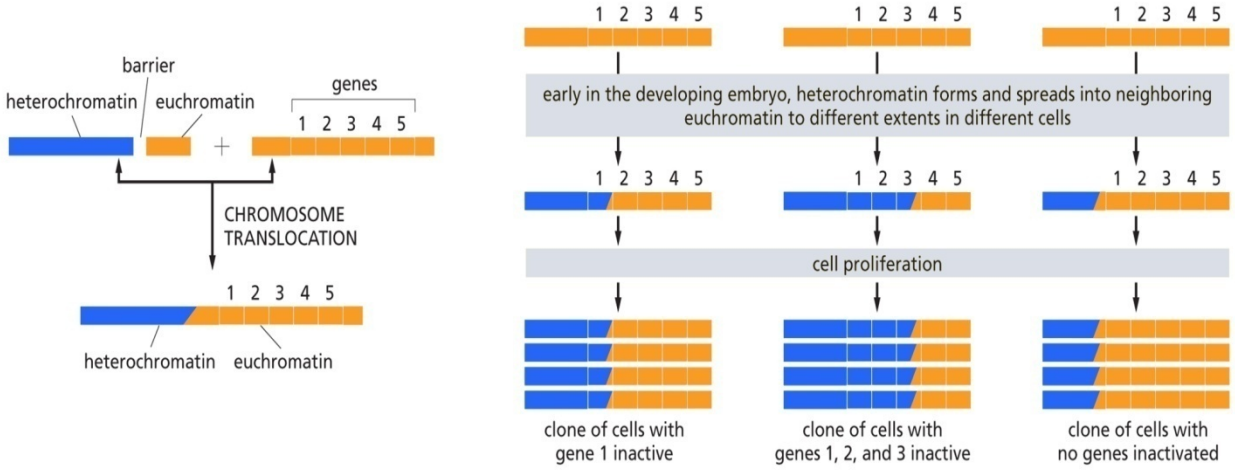
We have seen that gene expression can be regulated by enhancer or activator proteins when we discussed about molecular basis of recessive red mutation (December Issue 2014). There are many more ways by which gene expression can be regulated. One such regulation is called "transcriptional silencing". The term silencing can be applied to more than one situation. In this context, silencing is a position effect: a gene is silenced because of where it is located, "not in response to a specific enhancer or silencer site or activator or repressor proteins". In addition, silencing can be just one gene to large stretches of DNA, switching off multiple genes, even those quite distant from the initiating event. The most common form of silencing is called "heterochromatin depended silencing", it is associated with a dense form of chromatin called heterochromatin

DNA in the eukaryotic chromosomes are arranged in combinations with specific proteins (histones and the non-histone chromosomal Proteins). The complex of both classes of protein with the nuclear DNA of eukaryotic cells is known as "chromatin". Light-microscope studies in the 1930s distinguished two types of chromatin in the interphase nuclei of many higher eukaryotic cells: a highly condensed form, called heterochromatin, and all the rest, which are less condensed, called euchromatin. Heterochromatin represents an especially compact form of chromatin. It is highly concentrated in certain specialized regions of chromosomes, most notably at the centromeres and telomeres introduced previously, but it is also present at many other locations along chromosomes-locations that can vary according to the physiological state of the cell. The DNA in heterochromatin typically contains few genes, because of the condensed state, transcriptional factors cannot access in to the DNA, and when euchromatic regions are converted to a heterochromatic state, their genes are generally switched off as a result. However, heterochromatin encompasses several distinct modes of chromatin compaction that have different implications for gene expression.

Position effect.

Through chromosome breakage and rejoining, whether brought about by a natural genetic accident or by experimental artifice, a piece of chromosome that is Normally euchromatic can be translocated into the neighborhood of heterochromatin. Remarkably, this often causes silencing or inactivation of the normally active genes. This phenomenon is referred to as a position effect. Position effects first recognized in Drosophila, and later observed in many eukaryotes, including yeasts, plants, and humans.

The cause of position effect variegation in Drosophila.



A B

(A) Heterochromatin (blue) is normally prevented from spreading into adjacent regions of euchromatin (yellow) by barrier DNA sequences. In flies that inherit certain chromosomal rearrangements, however, this barrier is no longer present.

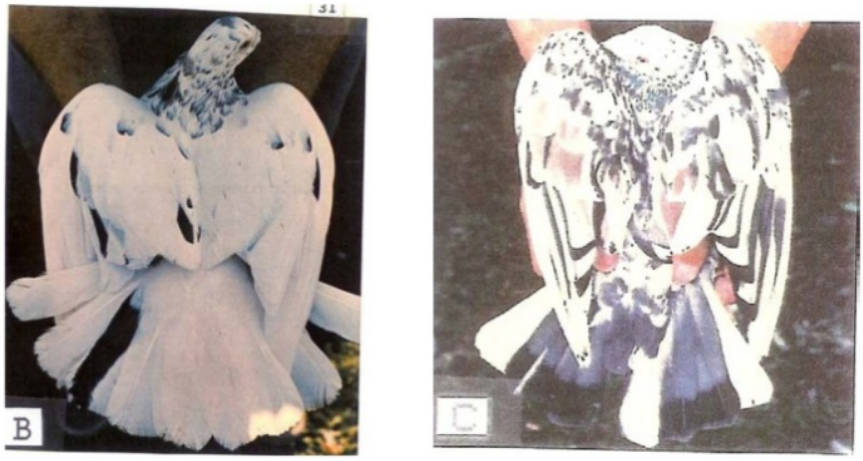
(B) During the early development of such flies, heterochromatin can spread into neighboring chromosomal DNA, proceeding for different distances in different cells. This spreading soon stops, but the established pattern of heterochromatin is subsequently inherited, so that large clones of progeny cells are produced that

have the same neighboring genes condensed into heterochromatin and thereby inactivated (hence the "variegated" appearance of some of these flies. Although "spreading" is used to describe the formation of new heterochromatin close to previously existing heterochromatin, the term may not be wholly accurate. There is evidence that during expansion, the condensation of DNA into heterochromatin can "skip over" some regions of chromatin, sparing the genes that lie within them from repressive effects.

In pigeons we know that Stipper ash-red het blue (stipper linked to ashred) and stipper blue het brown (stipper linked to blue) are lighter in juvenile with few colored areas of both recessive and dominant alleles. And as the birds ages, more and more recessive allele pigment will be produced and in old age most of the plumage will be blue/black (in case of stipper ashred het blue) or brown (in case of stipper blue het brown). This phenomenon and the breaking effect is possibly because of Position effect variegation, however it will be just a supposition until and unless we have enough data from molecular research. Fortunately, presently some Universities are researching on the molecular basis of some mutations including stipper present in pigeons. Hopefully we could hear what is exactly going on with the stipper mutation from them in future.

Above Left to right, first a stipper spread blue cock heterozygous brown (stipper linked to blue) after first molt, second is the same bird after second molt and third is its sire with same genotype. He is about three to four years old.

A stipper ash-red T-pattern heterozygous blue old cock (stipper linked to ashred) and tail spread of an old bird with same genotype, additionally kite bronze is also present

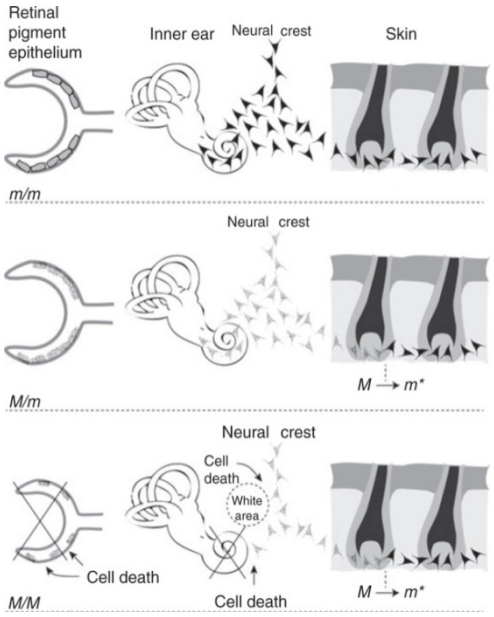


Two more birds with the same genotype except the first one possibly also spread and looks young. The above photos from an old newsletter.

Additionally we don't know the reason for semi-lethal and/or abnormalities of homozygous stipper. There is a mutant called „merle" present in dogs interestingly the mutation shows some similarities with the stipper mutation. Thought it might be interesting for you to know about the merle mutation while we don't know whether merle has any molecular relation with stipper or not. Merle is an autosomal, incomplete dominant. Homozygous merle is semi-lethal In addition; homozygous merle dogs occasionally exhibit deafness and ocular problems (microphthalmia, abnormal irises and/or blindness). Heterozygous

merle are small patches of normal colour appear within areas of diluted pigmentation where as dogs which are pure for merle are mostly white.

Molecular analysis mapped the mutation to a gene which encodes for a melanocyte-specific transmembrane glycoprotein whose intramelanosomal domain is cleaved and localizes to the matrix of eumelanosomes, where it forms fibrillar amyloid structures that serve as substrates for the precipitation and deposition of melanin. Because of the protein localized primarily to eumelanosomes, Merle typically spares pheomelanin pigmentation (red pigmentation). Mutations of the gene cause pigmentation phenotypes in other species, including silvering in mice and horses, and a series of plumage phenotypes in chickens.



Above diagram showing a proposed cellular and developmental basis for Merle-associated phenotypes. In dogs heterozygous for Merle (M/m), defective protein compromises eumelanosome formation, leading to a generalized pigmentary dilution. In dogs homozygous for Merle (M/M), increased levels of defective protein (a melanocyte-specific transmembrane glycoprotein) causes pigment cell death, which itself leads to abnormal retinal development, deafness and large white areas on the coat. "As described, the molecular nature of the M mutation is

unstable, which facilitates frequent conversion to what we refer to as a pseudorevertant m* allele". Pseudoreversion is shown here at the late stages of melanocyte development, but may also occur much earlier, giving rise to large patches of normal colour within a diluted area.

Mosaic look-alike stippers

Stipper birds sometimes show mosaic look-alike phenotype, it is caused by stipper, however we don't know the exact reason for this phenomenon. If position effect proven as true in stippers then that would possibly explain the reason for this mosaic look-alikes

Mosaic look-alike stipper bred by Jijo Thomas.

We would like to publish photos of birds with the given genotype at various ages

1) Stipper ashred het blue (stipper linked to blue)

2) Stipper blue het brown (stipper linked to brown)

3) Stipper ashred het brown (stipper linked to ashred)

4) Stipper ashred het brown (stipper linked to brown)

You may send to us, if any of you have them. We need to know their background information (either colour of parents or colour of a considerable number of offspring out of them to prove their genotype) and age of bird.

That is it from the Pigeon Loft, hope you found something interesting and helpful, and please feel free to send us your genetic activities for future articles!! I want to thank Jith Peter who during my time of tremendous upset and grief, took on the entire Newsletter himself! This Family of Alleles is a large and complex subject and I think he has provided all of you with an excellent Issue!

Bob Rodgers.

A beautiful checker pattern almond Indian fantail, photo from a face book group.