The Pigeon Genetics Newsletter, News, Views & Comments.

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June 2020

This month's Topic : "PHASES" have we got it right ?

Photo by Porumbei Colorati of his blue bar/ Lemon/Ecru/Extreme dilute male.

Back in the mid-eighteen hundreds , J.C. Lyell of England wrote in his last Book "Fancy Pigeons" , that Breeders had discovered a rather unique colouration in pigeons in several lofts that came from normal blue stock but were a very light Silvery tone. It was eventually named "Silver" and they realized that if they mated these females back to their sires , they could raise more in both genders and then by mating brother and sister silvers or any two silvers, they could be certain of all silver young. This became known as the dilute phase of the Blue series. Photos : **Attaullah Saleem** , **Octavian Sarafolean** ,

Later it would be realized that there were two mutations at this genetic Locus as well as the wild type Intense phase. The other, being 'Pale' phase, was at first considered to be about half way between Intense and dilute. That has since changed to be 1/4 way between Intense and dilution. Dr.Hollander prophesized that one day there would be an 'extreme dilute phase' and even went so far as to name it and give it a symbol and a description which was an extremely odd approach by a scientist. He said it would be white or nearly so , and gave it the symbol (d^wh). Photo - (1) Lemon Blue bar **Clint Robertson**, (2) a Lemon Blue bar **Australian Facebook Group**., (3) spread ash Lemon /Ecru/ extreme dilute by **Andreas Boisits** , (Note how overall photo colour/lighting can change apparent phenotypes)

A racing Homer Breeder in Africa had a cream coloured bird appear in his flock of blue series Racers , and we all have heard of the so -called 'Lemon' which was eventually sent to the U.S.A. and renamed 'Ecru ' by **Dr. Paul Gibson** as it clearly was not a lemon yellow as advertised. The trait has been placed in most breeds as it is a simple recessive , and many claim to have proven that it is indeed Hollander's predicted Extreme dilution despite a number of contradictions both in breeding results and actual phenotypical expressions.

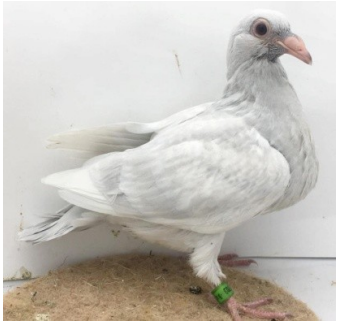
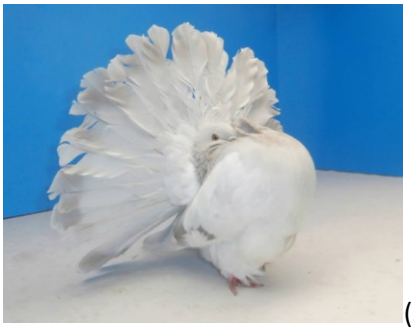
Then a gentleman from the Netherlands , who lives and works in England, made a rather stark new observation. His name is **Hein Van Grouw**. You can Google his name and follow much of the work he has been doing in the study of bird feather colourations. He suggests that Pigeon Breeders have it wrong. Our 'milky' factor is actually bird dilution by definition , and our pigeon dilution is what he calls '

ino' , a form of albinism . Here is where things start to get a bit complex. However they also may actually make a great deal more sense !

I asked **Hein Van Grouw** for permission to use some of his material both from the Net and from a Discussion Paper that I circulated a while back to include : Hein , Andreas Boisits, Axel Sell, Jith Peter , Paul Gibson and Robert Mangile . Robert did not have anything further to add so declined taking part. The discussion paper dealt with several topics such as we are discussing herein. Due to the Corona Virus Hein's Office was closed , so I did not get his response , but felt he would not object to his material being added. Permission was given by **Axel Sell** and also by **Robert Mangile** for his lemon test results..

If Pigeon dilution is in fact "milky" factor -

We would have only one mutation at the dilution locus called milky , and an extreme of that would quite conceivably be a white bird with perhaps just a hint of gray, ash , or brown . Photos : (1) Milky or 'powdered' blue checker **Grzegorz Szpryngiel** , (2) Powdered Silver (milky dilute)- **WildBrier Lofts**. (4) Milky blue - **Limur A,Anna Justovi**. (Note how similar all phenotypes are !)

(1)  (2)  (3) 

Ino on the other hand would offer us a plethora of phases starting with wild type Intense , then Pale , then a pigeon dilution look-alike, and then possibly quite a range of variations from possibly a dark gray or even a brownish tone , through Ecru to white with just a faint hint of base pigment in some. Should this prove to be actually what we have before us , it will take considerable getting used to. The ino phases are commonly seen in Species of parakeet/ Lovebirds etc. The range of tones and combinations seems endless. All are pink eyed as one would expect in the nest with albinism. Our so -called Extreme dilute is certainly very pink eyed in the nest .

Hein describes an 'ino' as such : Ino is defined as a strong qualitative reduction of eumelanin and phaeomelanin. In this mutation, phaeomelanin has (almost) disappeared and there is hardly any oxidation of eumelanin. Black feathers will turn very pale brown (almost white).In fresh plumage, colour and pattern are vaguely visible. Especially in species with a natural amount of white in their plumage, it can be seen that there is some pigmentation left in the remaining non-white plumage. In an ino, the plumage parts, with normally the highest pigment concentrations, remain the most clearly visible parts, for instance the black cap in Western Jackdaw. Old plumage is almost completely white in an ino because the feathers are bleached by (sun)light. An ino has reddish eyes because pigments have disappeared there as well. But the eyesight of an ino is much better than that of an albino. It can be stated with great certainty that any adult

‘white’ bird with red eyes in nature is an ino, not an albino. In most species, the inheritance of this mutation is recessively sex-linked.

Photos : (1) Intense phase Germany **Mick Bassett** , (2) Pale phase Germany **Bassett**, (3) Pale phase U.S.A. **Tim Kvidera**, (4) dilute phase **Tim Kvidera**, (5) Extreme (Ecru) Butterscotch **Tim Kvidera**.,

(1)  (2)  (3) 

(4) 

(5) 

Below this 'Chondon' Breed in India appears to be smoky on Gimpel selectively bred for generations . Note that there are at least six distinct phases from the darkest to the lightest. Smoky , milky , blue and ash base , and possibly present-day Pigeon dilution, may be involved , not much is known genetically.

Below : (1) **Sarwar Zaman Chowdhury,** (2) **Abdul Halim** , (3)smoky dilute -**Pigeon World** , (4) , (5) , & (6) **Sarwar Zaman Chowdhury**. (Hope we have these credits correct).

(1)  (2)  (3) 

(4,5, & 6)    .

Robert Mangile did tests with crossing of the Lemon Pigeon and the 'recessive'white Ringneck Dove. Editor's Note: The white Dove expresses a yellowish tone in the under tail, neck ring and has nestling pink eyes indicating that it is possibly a form of albinism and therefore possibly 'ino' , but it is considered to be extreme dilution with symbol (d^w) The symbol given for the extreme dilute pigeon is (d^wh). The same result would present itself from the cross no matter if we called them both extreme dilution or both ino. Paul Gibson suspected at one point that Lemon was in fact 'ino'. We have presented Robert's test details but added our take on it to make it compatible with the 'ino' topic

Robert Mangile Tests on Lemon Pigeons & white Doves..

Figure 3. Four newly hatched squabs – as follows: (A)-lemon pigeon X dilute-white dove hybrid, (B)-dilute-white dove, (C)-lemon pigeon X dilute-blond dove hybrid, (D)-lemon pigeon.

First we will explain the Basic phases in Doves :

Wild type is the intense phase in Doves : Photo (1) : from Show in NB Canada by **Ryan Ward**. Pigeon **dilution phase** in Doves is "Blond" which is a lighter fawn colour on the shields and flights in particular.

Below Robert's photos of young : The first squeaker photo shows a 'dilute white Dove '.,

NOTE: Dilute whites in Pigeons are bull eyed recessive whites that have a dilute phase of one of the three base colours in its genome which is not visible due to the recessive white gene and they have bull eyes, in fact all pigment colour is blocked by the gene. The squeaker below is a 'dilute white dove' that is pink eyed in the nest but develops more pigment in the Iris as it matures. It has no equivalent in pigeons if Lemon is not either extreme dilute or ino.. and unless both can be proven to be the same trait, which I assume Robert feels he has done. Paul G. stated in a newsletter that this cross proved nothing .

dilute white dove (d^w) , considered to be extreme dilution.

The next two , a hybrid of a lemon pigeon X a 'dilute white Dove' (d^w).

This would be the equivalent of two lemons mated together in Pigeons. Note that it is indeed nearly naked and pink eyed in the nest , and considered red eyed as an adult..

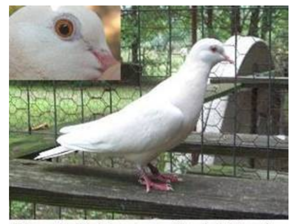


Figure 2. Adult lemon x white hybrid cock.

The next two, a hybrid of a Lemon Pigeon mated to a "pigeon" dilution" - 'Blond' Dove.

This would be the equivalent of a dilute pigeon split for Lemon /Ecru, note how much more down hair it has then we would expect on a dilute pigeon and the fledged stage seems to show more influence of Lemon then would be expected in a dilute phase pigeon split for lemon.. also looks like Orange eyes.


Figure 4. Lemon X blond hybrid.


Photo of a pure dilute blue series Pigeon squeaker : Bob R. , Note that it is nearly naked and has been since emerging from the shell. , dark eyes but it is a pied also.

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Below : A Lemon /Butterscotch Archangel Bred by **Brad Stucky** U.S.A. Note the very light coloured eye Iris. I have asked Breeders to check the eyes of newly hatched young and then show the adult color.
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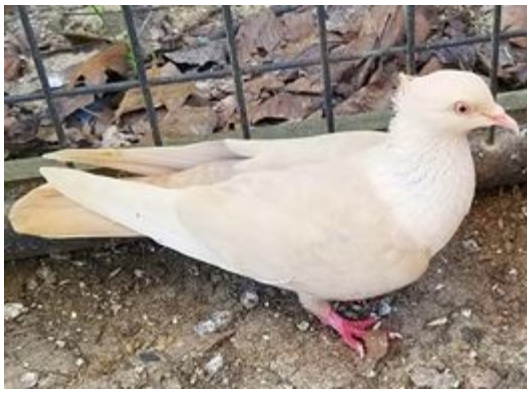

Below edited comments re - (ino) by Hein from the discussion paper..

Yes **'pigeon dilution'(d and d^P) is indeed in my opinion a qualitative reduction what means that the amount of pigment granules is not changed, but its colour is changed due to an incomplete melanin synthesis. As mentioned before, this is demonstrated especially in 'diluted black'; the colour is not grey but it is far more 'brownish' and many diluted blacks are almost impossible to distinguish from Spread Brown**. In modern Genetics the 'pigeon dilution gene' is comparable with a gene known as Slc45a2.
In 'science dilution', a quantitative reduction, the colour of the melanin granules is not changed; it is still black, but the number of granules is reduced (or they are more clumped together), leaving more space between the black granules and therefore we perceive it as grey (and red as pinkish and NOT yellow). Milky is an example of 'science dilution', and so is reduced and Ice. The latter-named, however, is a rather rare form of dilution as it affects the plumage with clumped pigment far more than the spread areas (the same mutation is found in the Ringneck Dove and the Black-headed Gull *Larus ridibundus*). Dilution roughly comes in three forms (but there are far more different mutations which fall all into one of these three categories); both melanins (eu & phaeo) affected, eumelanin affected but phaeomelanin unaffected, and phaeomelanin affected but eumelanin unaffected (the latter is rare)

I think, but I cannot be sure yet, that lemon (ecru) is an allele of d and d^P, and indeed, Hollander predicted 'extreme dilution (=Ecru), mainly based on the (probably) same mutation in the Ringneck dove. This mutation, often called 'white' (but it is not white; it is very pale cream-coloured with a darker cream-coloured necking and tail bar) is an allele of the mutation known as 'Fawn' or 'Blond' in this species. Hollander (and Wilmer miller) established years ago that Blond (Fawn) in the Ringneck dove was the same mutation as 'Dilution' in the domesticated pigeon (based on my own breeding tests I agree with them).
The gene responsible for these mutations (I call the gene Ino) is recessive and sex-linked, is common in all bird species and has proven to mutate easily as in many species multiple alleles are known, e.g in the Ringneck Dove, House sparrow and carrion Crow two different 'Ino mutations' are known, and in the Zebra finch even three. And possibly in the pigeon also three IF Ecru is indeed an allele of d and d^P.

Whether Hollander predicted the final appearance (fenotype) of Extreme dilution (Ecru) I do not know but I would think that Hollander, with his knowledge, didn't as the fenotype depends fully on the total genotype: an Ecru Blue bar appears far more 'white' than an ecru Blue T-pattern. What they do have in common, however, is that the original darkest parts of the plumage are also darkest in Ecru (the original

black parts are very pale brownish and NOT grey), so Ecru makes a pigeon extreme pale but the original patterns and markings stay visible just as, for example, in the Ringneck dove (keep in mind, however, that most 'extreme diluted' Ringneck doves nowadays are combined with other mutations as fanciers (and the judges!!) wanted a white' Ringneck Dove).

If Ecru/Extreme Dilution or whatever we call it indeed is what I think it is (a mutation similar to what is called Ino in other species), then both melanins, eu and phaeo, are very incomplete oxidized. In other species Ino oxidises phaeomelanin more than eumelanin, and brown eumelanin more than black eumelanin. What I can see in my (only) ash-red ED bird is that the phaeomelanised feathers have a deeper visible colour than the coloured feathers in the ED birds in blue. So, in my opinion, depending on the base colour, the colour resulting from ED is different.

The fact that there is hardly any visible pigment left, and therefore the entire bird looks 'muslin coloured' is in my opinion not masking but simple the result of the mutation; leaving hardly any visible pigment and therefore patterns are hard to distinguish (although, the latter is in my opinion not the case; see * below).

The Ino Ringneck Dove is often called 'White', and after years of selection, and (unconsciously) combining it with other, 'diluting' traits most of them are indeed near white, but they still show the neck ring and tail markings very vaguely. In the single mutation, without any other traits, the neckring and tail markings are clearly visible in an ecru??(coffee with lots of milk) colour.

*However, back to the ED pigeon, in my opinion there is still a clearly visible colour difference between the different pigmentation areas (clumped, coarse and smooth spread), and in fresh plumage the pattern is easily seen and recognised (as said earlier, the pigment in ED plumage bleaches very rapidly in the (sun)light, and in older plumage it is indeed more difficult to recognise the different patterns).

One thing is a fact; whatever colour, pattern etc. a ED pigeon is, it is so difficult to capture its true colour in a photograph. I'm certainly not a good photographer, but so far I have not managed to take a photograph of one of my birds which reflects its true colour correctly.

A few weeks ago I got two Ino hens (blue spreads) and a heterozygous blue chequer cock from Austria. The ino birds in combination with spread are total different ,as expected, as the ino birds without spread (eg. bared or chequer). The plumage of Ino, as all qualitative melanin reductions, is very (sun)light sensitive and bleached rapidly further to almost white. When I got the ino hens they were nearly white. Their freshly grown new feathers, however, are clearly 'ecru' coloured. My first attempt will be to get a crossing-over to get Ino in combination with the Ash-red base colour.

Soon I'll send a few pictures of the birds and I'll keep you informed about the results.

Best wishes. Hein

I understand from this that you are now considering the "Lemon /Ecru " to be ino , and that it is a qualitative reduction. That of course alone would place it in a different category from dilution since Axel has indicated two studies that state pigeon dilution is a Quantitative reduction of

melanin , and as I said in the Discussion Paper , Jith shows clearly why they would have to arrive at that conclusion. I want to make certain that we are all on the same page in every aspect of this topic . ~ Bob

Hi Bob, Yes, I still consider it {lemon /Ecru/ Extreme dilution to be } 'Ino'.

And indeed, in pigeon dilution besides the qualitative reduction there is indeed also a quantitative reduction, but the main difference between Dilution and, for example, Milky is in my opinion the qualitative reduction in Dilution. Diluted Blue bleached rapidly in the light, while Milky blue does not.

So yes, although the distinguishing between qualitative and quantitative reduction is not totally accurate, it works for me as, as said, the qualitative reduction (change in colour of the actual pigment granules due to affected melanin synthesis) is the main difference.

The following by Axel Sell with permission.

Hello, it is interesting to get a view from another perspective on the taxonomy of genes that produce a lightening of plumage in their specific genetic environment. **Genes of the dilution group are allelic and so it makes for me sense to separate them from milky, ice, opal and other lightening traits. These traits might for themselves appear in combination with dilution.** Interesting the hint on often more than one gene with a similar effect at the sex-chromosome identified in other species. That sheds a new light on the controversy about extreme dilute and the allelic debate. Hein mentioned milky, ice and reduced as quantitative reduction and that should be called dilution. They were characterized by a reduction of the granules. Dilutes in pigeon terminology were in contrast characterized by a qualitative reduction. **I do not remember the source of this finding, however, Lloyd-Jones in 1918 just found for dilution in his microscopical and chemical study of the feather pigment the quantitative reduction also for dilution: "Dun color is produced by the same pigment which produces black; the difference between the two colors is chiefly a quantitative one**". Also our study on Melanin Concentrations in Feathers from Wild and Domestic Pigeons from 1992 got this result using a different technology. The formation of color in feathers is not yet fully understood. Production of melanin, transport and fixing in the cells, melanin synthesis processes, mentioned by Hein, and other mechanism are involved and genetically determined. Thus different shades and dilution-likes with another genetic basis should not be such a great surprise. Hopefully the discussion might lead to some further investigations in respect to extreme dilute.
Regards - Axel Sell.

The following from Jith Peter :

Sorry for the late reply, but I have been going through a tight schedule. It was interesting to read the Article " The Causes and recognition of common colour aberrations by Hein, especially the classification of mutations which affect pigment production based on the way they result in the reduction in pigmentation. I was not aware of any research on pigments in dilute mutants except the major research carried out by the University of Utah until I read one of your responses here . According to the U of U, the dilute mutation happened at the Slc45a2 gene which is a transmembrane cation exchanger (Na+/H+ exchanger) localized to intracellular structures consistent with the membranes of melanosomes. The mutation results in reduction in the function of the gene (in other words dilute is a hypomorphic allele) which in turn increases in acidity within the melanosome (where melanin is produced in the melanoctyes). Since tyrosinase enzyme requires a specific pH, the change in the pH reduces the Enzymatic activity which in turn reduces melanin production resulting in hypopigmentation (see issue march 2015 for better explanation) According to their findings the quantity of the pigment produced in dilute mutants is less than that in the case of wild type. I guess Hein thinks that the"dilute mutation in pigeons" results in qualitative reduction because, unlike other species (where black becomes silver grey), it alters black to dun which is very similar to brown mutants in phenotype. Perhaps some other factor/s is/are responsible for that dissimilarity between the two observations , many of these things are still unclear. However I would like to mention that, since the quantity of the melanin produced in dilute mutants is less, it may well be affecting the quality of the melanosomes, because, in similar cases in other species, along with a reduction in pigment content, the melanosomes where the melanin is produced are small and irregularly shaped. Given the description of the "ino" gene, I concur with the statement made above by Bob regarding Ecru : { this suggests to me that Ecru is a somewhat mid-way phase of ino and that any extreme phase has yet to mutate".} Even though there is still argument about the allelic relationship of Ecru/extreme dilute and dilute, I would like to keep an open mind on this. (suppose if both are alleles) In Humans around 20 mutations in Slc45a2 gene are responsible for oculocutaneous albinism with varying degrees of pigmentation. Mutations in this gene are also responsible for albinism in Kangaroos and Zebra fish, so yes, it could well be possible in pigeons that a mutation results in zero activity of the gene (null allele).

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The purpose of this Month's Topic ., is to shed more light on the complexity of the "Extreme dilution" theory , and to try to zero in on some of the key points that may make or break the idea that we can easily identify specific traits simply by determining if they appear to be allelic. We can see by the point that Hein makes , that if we started out with an incorrect identification of a 'phase' based upon what it
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'looked' like as opposed to how it was genetically produced , then we could easily arrive at any number of false conclusions as time goes on.

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Notes on ecru/lemon by **Paul Gibson** : Blue bar and blue check in ecru/lemon have visible tail bars. Ash reds and indigo ecru do not have visible tail bars. Recessive red ecru look exactly like spread ecru. Ecru birds whether on a blue/black base or ash base are very similar in color. Ecru with T-pattern bronze are identical to those without the bronze. All are the color of unbleached muslin but darken somewhat with age to a soft cream khaki no matter whether the base color is ash red or blue/black. Brown ecru are somewhat darker than the blue/black and ash reds. Ecru bar and ecru check Ecru check Ts bronze (ex Saxon whitetail) It is interesting that no matter whether the ecru are ash red, blue, indigo, het toy stencil, black, rec. red, are bar, check or t-pat , they all are nearly identical in being a light tan shade or ecru coloration. No other traits except rec. red and white have this overall blanketing of unified color. The one color that ecru does not affect as much (that we know about) is brown. For some unknown reason the brown ecru birds have darker brown markings, Jerry has reared several brown ecru and I have two, a bar and spread.. **PG**.

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Back to our main subject. Rather than going into difficult jargon in my opinion you can divide the differences in 'a paler plumage coloration' roughly in two groups; 1)the melanin granules themselves are changed in colour ('qualitative reduction', e.g pigeon dilution (and pale), ino/ecru and Brown) or 2) the pigment granules are NOT changed in colour but as a result of their distribution in the feathers we see a different colour ('quantitative reduction', e.g. milky, ice but also bleached and drizzle)
The first category gives 'brownish' colour tones (and genes involved effect the melanin synthesis and therefore are 'tyrosynase related' and the second results in greyish tones.
Of course there will be cases which appear to be (or even are) exceptions, but roughly this works in my opinion.

With very best wishes.
Hein

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The name Pink eyed dilute will give reason for some to question if this trait also might belong to the dilution locus . These birds however have tested out to be autosomal as opposed to sex-linked , therefore not an allele at the dilution / ino locus. Smoky factor is identified as present along with a type of vision problem or 'feed blindness'. ~ Bob R.

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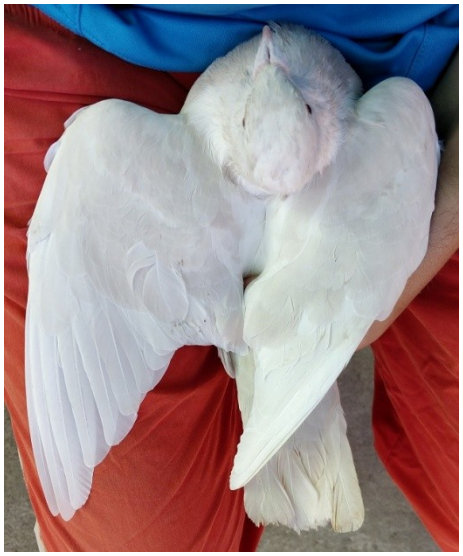
Doc. Hollander's Son **Paul Hollander** once wrote in a past Newsletter in response to a statement made by another member regarding Ecru/Lemon not being the extreme dilution that Hollander senior predicted : "An equivalent of pale is not present in the ringneck dove, so why do we have to claim that lemon/extreme dilute/ecru is the equivalent of white in doves? Why can't lemon/extreme dilute/ecru be lighter than pale but darker than a not yet discovered more extreme dilute? From the pictures I've seen of lemon/extreme dilute/ecru pigeons, I consider it possible. " end quote .

It is very unlikely after all these years that we will change the dilution locus to 'milky'., or rename it 'ino'. Equally unlikely that we will change the majority in their thinking that we now have a fourth phase at the Pigeon dilution locus called 'extreme dilution' , unless of course it is discovered in the laboratory that something very different is fact. Each of us will have done our part to try to sort it out and reach a consensus as to what is taking place genetically speaking. ~ Bob R.

We leave you with a few more photos from our friend Porumbei Colorati on Facebook: This is a Spread factor blue series Ecru cock showing colour changes from fledgling to adult ., based only on the first photo I did not expect spread factor blue/black. Dirty factor and sun bleaching may be involved.



That is it from the Loft for June .. see all of you in July , stay safe , and let us know what YOU think !