

Black white shield partial Black white shield Pepperhead from Black White Shield

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ARPAD CSEPLOA WRITES: 7dec'08

How does it possibly technically? Does the gene, called Stipple affect only its own side and leaves the other side untouched? Is it something like the gene Stipple eats up the black cover and the otherwise recessive brown become unaffected and visible? Could you explain more about this?

EDITOR:

I had written that an almond that is hetero for black and brown with the almond gene on the same chromosome as the black is why the main part of the bird was brown.

EDITOR:

Arpad, it is not that the Stipple gene eats up the black cover, what happens is the almond gene prevents the black from depositing pigment in random areas and this lets the covered recessive, in this case brown, show its effect on the phenotype. Think of it sort of like a colored egg. By dying an egg brown and then covering part of it with wax, then dipping it in black; the wax prevents the black from coloring the areas where it resides. This lets the brown show.

RIP WRITES: 16dec,'08 (referring to Dick Crybergs post on rules of nomenclature.
>>> The rules of naming things are quite clear in science.<<<

I beg to differ, those same "rules" also state that the senior nomenclature takes precedence.

The mutation found in the Barkel birds was first called "lemon", later someone improperly decided that the mutation should be called "ecru" and of late other "self-appointed experts" have decided that it should be called "exteme dilution".

These same "rules" state that "extreme dilution" is an invalid synonym for lemon and is unavailable for use by the fantail people for "their" mutation unless

they can prove that they had it in use prior to it's being used to improperly describe the Barkel lemon mutation.

I'd like to point out that, personally, I think the term "extreme dilution" is inane for any mutation, it presupposes that another more extreme mutation at that locus will never occur. What would the person who came up with "extreme dilution" call such a mutation should it occur? Extremely extreme dilution?

We are currently in the middle of a long thread about mis-applied, redundant names for mutations, this is a classic example that can be "nipped in the bud" right here and now. It is my understanding that the Barkel mutation was first found to be a discrete mutation and described as lemon in South Africa, therefore the mutation is "lemon", not "ecru" or "extreme dilute".

NICO WRITES: Carltonville, South Africa

I am new to this group. I have very recently got involved with Lemon. I am in the very lucky situation that I live about 50 km from Jack Barkel. I paid him a visit and bought a Lemon cock to introduce the colour into my Fantails. When I was with Jack we had a discussion on the colour and the other names involved. At a later stage, I sent him an e-mail to find out what he claims as being Lemon. When you go to his breeding station, you will find that he only breeds Lemon from Blue Bars and Blue Checkers. One of the reasons being, that he sets a lot of value to the bar in the tail.

The question therefore needs to be asked is if Lemon does only refer to the Extreme Dilute factor when found on the Blues or in all cases. Jack confirmed to me that he only claims the Lemon colour when there is a bar in the tail. We know that in the case when the factor is found on Ash-red there will be no bar. I have been informed that when the factor is found on brown you can not see the difference to when it is found on Blue.

EDITOR:

Rip, your interpretation of the rules and my interpretation of the rules are the same.

The problem occurs in interpretation of the events surrounding the "lemon" name. First, Mr. Barkel never found it in his birds. He bought it from another fancier. He called the phenotype lemon AND biscuit. He did not describe the trait as a genetic one (or give it a symbol) but rather as a phenotype. From this bird he developed a line of Homing Pigeons which included this mutation and blue bar & blue check Homers. This line he called his lemon line. Mr. Barkel was not naming the trait. In fact, he stated that unless it was a Homing Pigeon (either bar or check) with a tail bar, it was not lemon and that all other colors, crosses, etc. were not lemon.

The ads he sent out depicting the coloration was color enhanced so that the pictures of this trait were lemon yellow. Correcting the color of the legs showed this coloration to be more of a light tan like unbleached muslin which is a color named ecru. Acquired birds showed that indeed they were this color. That is where

the genetic name came from. This is the color of the trait genetically whether it is blue, brown, ash, rec. red, spread, etc. under this recessive mutation. When we acquired some of his lemon homers, both colorations were sent as lemon and his instructions were to always mate hens of this coloration to blue males thus maintaining true lemon line birds. As my friend Doc. Hollander would have said, lemon is not mnemonic for this trait.

This manner of phenotype and genotype naming is common throughout the literature of pigeon genetics. There being several phenotype names for several of the genetic named traits. The worst are probably almond and ash red.

Concerning the name "extreme dilute", this was borrowed from a comment made by Dr. Hollander many years ago about extreme dilute found in ringneck doves. The comment was that probably we would see something like this in pigeons. The ringneck dove exteme dilute is white with only the neck ring showing color. It cannot get more dilute than this.

The other question about the name "extreme dilute" being used in pigeons. And yes, they (the Ralph Smiths) had it many years prior to the "self-appointed experts" used it. Ralph Smith has been working with it for many many years.

Frankly even though I was one of the three that published the name of this trait genetically as ecru; I couldn't care less whether it is called lemon, biscuit, ecru or whatever. My main concern was to establish that this new trait was genetically based and how to use it to produce the coloration in any variety or color of pigeon.

The trait is still under study by several of us because of some incongruous results of matings. We are pretty sure the trait is not an allele of dilute but is on the sex chromosome near the dilute locus.

<u>MIKE HUGHES WRITES:</u>

The following is from a discussion on the fantail group, has anyone heard of this "other" extreme dilution?

<u>ANDREW KERNS WRITES:</u>

I had a couple of the extreme dilute from our gene pool birds a few years ago and wrote an article on them with pictures in a past EFC bulletin. I do not have them anymore as I could not raise one with sufficient eyesight. Many were blind or partially blind. The eyes were very pink at birth and remained so for a long time. I saw first hand the lemon project birds last weekend at the Pageant and talked to Drew about them. I do not think that we are working with the same thing here, two different mutations with very similar phenotypes but from different sources.

The extreme dilute gene originated in a strain of flying rollers in Mississippi that was discovered by Ralph Smith's father. These were crossed onto fans and that is where mine came from. There were determined to be sex linked and recessive in nature. Drew told me that his have no problems with eyesight and come from very vigorous homer stock. It is no surprise to have such a mutation from different sources since this is a niche that genetic[lists] had been looking to fill since the determination of an extreme dilute type in ringneck doves.

DICK CRYBERG WRITES:16dec.'08

The name extreme dilute is already taken by the version from Barkel. No other version can be ethically use the same name so the Fantail guys need to find another name. The rules of naming thing are quite clear in science. The rules clearly state that to call this new mutant extreme dilute is unethical.

EDITOR:

Dick, you are mistaken. The name extreme dilute was used by Ralph Smith years before the "version" from Barkel saw the light of day. You have your facts twisted 180 degrees from the actual facts. If the name extreme dilute is to be used, it is the domain of Ralph Smith's Fantails that own it. The name extreme dilute for the Barkel lemon was coined a couple years after the "lemon" mutation was genetically named and published as ecru. And to make matters more confused is that the lemon mutation probably is not at the dilute locus but resides on the sex chromosome near the dilute locus.

DICK CRYBERG ANSWERS Mike Hughes email: 17dec'10

Exactly what does that have to do with anything? Zero data has been published on this trait in Rollers. No data has been published that shows it is a dilute allele. Some claims have been made that it is sex linked. So what? Those claims are meaningless without published data. Science, as wells as other scholarly work is based on data, not age or unsupported claims. Would you consider it proper to name individual grains of sand simply because they are old?

MIKE HUGHES REPONDS:

It seems to me it might have everything to do with it. First off, I'm not arguing, just asking questions because I'd never heard of this. How do you know that no data has been published? Why does it have to be an allele of dilute to be named extreme dilute? Pink eyed dilute is not an allele of dilute? So I'm trying to find out if there has been any data published on this extreme dilute that evidently mutated in Mississippi? (anybody?)

EDITOR: See article below by Drew Lobenstein on page 896.

As I had written above in 2008. We (Jerry Sternadel, Jim Muckerman, and myself) thought that probably the gene for ecru (lemon) was not an allele of dilute. I stated in my 2005 book "Genetics of Pigeons 2005" that ecru appeared to be but had not been proven conclusively that ecru was an allele of dilute. Jerry and I had some breeding results that did not jib with that concept. We have been testing and Jerry and I have breeding results that join those of Drew Lobenstein that will prove beyond a shadow of a doubt that the gene for ecru is NOT an allele of dilute.

ANDY REED WRITES:

Here is one for you genetic guys who are working with homing ability and performance. A few years back, one of my friends had a standard fantail mated

with a flying tippler. They were very prolific and he soon had a flock of loose flying large tailed birds. I borrowed one to breed into my birds.

Afterwards he said to just let the bird out and it would come back. I had my doubts, so I took the bird across town – halfway to my friends house – and let her go. When I got home, there she was trying to get back into my coop! How did she do that? I had never let her out! Any thought?

EDITOR:

Andy, you experienced what a number of us have experienced. This is not a genetics problem but a problem for those that study homing ability. Many birds of several breeds or crossbreeds will do this. Not just across town but from 30 miles or more away.

I personally had Archangels return from over 50 miles away. These had never been out of my loft either.

MOHAMMAD FROM KUWAIT WRITES:

I have something that's killing me in some project I'm doing with reduced. I want to produce yellow carrying reduced cock and for a fact, I think it's impossible but with my thought, I'm trying my last project and it is to use a yellow reduced hen on a standard yellow cock to produce a cock carrying dilute and reduced. I bred them a couple of times and all I got were duns and yellows and I presume these were hens not cocks. So in my last breeding I got a red cock that is carrying reduced and carrying yellow from his father so my question is if I breed him back to his mother, the yellow reduced hen will I get yellow carrying reduced cocks??

EDITOR:

If the hen is already yellow reduced, then the red cock bird has the combination on one chromosome. If you mate him back to his mother, you should get some yellow reduced cocks. The hard part about such an endeavor is to get the crossover to produce the dilute and reduced on the same chromosome. Since you have accomplished this, the rest is just a straight combination that can be done by inbreeding. Half your cocks should be homozygous for the dilute/reduced and half carriers. Also half your hens should be dilute-reduced.

DREW LOBENSSTEIN WRITES: 17dec'08

In 1975, I got an andalusian colored pigeon from Bill Hawkinson. He had raised it and several others from an andalusian LFCL Tumbler in both blue and brown. When I first saw his creation I imagined andalusian Jacobins…and thus started my adventure into pigeon genetic projects.

I used the gorgeous colored andalusian owl cross on the best black Jacobin I could acquire (thanks to Ed Buchmann) and in two years raised thirteen youngsters…one of which was an indigo checker hen and the thirteenth youngster an andalusian with the Lenardo tuft on the back of the head. It was the second year that my friend Harry Alexander pointed out that the indigo checker which was the first one out….was the makings for andalusian and that I did not need to wait for

the actual andalusian to progress on this project. I have learned a lot about pigeon genetics in the following thirty plus years….indigo is the factor that with modifiers can produce the andalusian color.

In the next five years or so I produced indigo in barless, bar, checker, saturated checker and spread in both intense and dilute and heterozygous and homozygous offspring. My point here is that only the spread blue indigo is called andalusian. The others are called by their various characteristics dilute spread indigo and indigo checker and so on.

When I saw Jack Barkel's mutation in color photos included in an ad in a Racing Pigeon magazine…called Barkel's lemons…I had the same feeling come over me that I had about producing andalusians. I was able to acquire two Barkel strain birds from the Breeding Station in the U.S. …and have introduced those Barkel lemons into just about everything I own, including Jacobins and Fantails. My Fantails are in their fourth generation and I have experimented freely with them based on information from others who have shared what they know. My third generation Fantail is lemon and indigo, spread and hetero recessive red. She is gorgeous ….and so is her bar pattern sister. If the bars and checkers in blue only are to be called lemon…what do I call my indigo spread hetero recessive red? (lemon, ecru, extreme dilute or Bovian Werds?) I am currently calling my project lemon in deference to the discoverer himself and with the hope that when I use the term to describe my pigeons ….most people know what I am referring to.

If it becomes common genetic practice to use other terms to describe this character which like indigo can be put into every possible combination of modifiers …I will abide by the consensus. For now my fifth generation Barkel strain Racing Homers are passing for Fantails.

At any rate…Nico, both your communication and your sharing of my project with Jack Barkel himself and your desire to make lemon Fantails too…inspires me no end.

<u>DREW LOBENSTEIN WRITES:17dec.'08</u>

Not to belabor this any further…I can observe that in two years my silver check F2 Fantail cock bird split to Barkel lemon…when mated to a recessive yellow over indigo spread hen produced two lemon indigo spread hetero recessive red daughters and silver checkered daughter. Mated to a blue hen the silver check cock has produced two bar lemon hens and two blue cocks and one silver hen. Take it for what it is worth…I have a pair mated to test pale, dilute, and lemon…but no offspring yet.

<u>CSEPLO ARPAD WRITES:19dec'08 excerpts</u>

About the G Modena, I estimate that this case it is St//+ bird on black, dark check, homo Ts1 (Mahogany), e//+ I don't know, V//V and So//So maybe, K//? not. Same like this youngster below.

If I learned well, Ws phenotype depends upon e//e. Only e//e is missing you can't see anything from Whitesides. (However, it might circulate further in the genome). [Bill Peterson] you are right, there is a black whiteshields (notice that I

changed the term, in order to express the difference) in some breeds, but it come from another trait (another way to Rome).

The trait named by A. Leiss 'Pseudogrizzle' (G^Ps) is related with tiger grizzle (G^T). Very hard to obtain a proper phenotype, and always need to pluck to be clear. It goes on Spread black only and seems not possible to reach blue whiteshield. How it goes when a bird is both Ws//Ws and G^Ps//G^Ps, remain a question to me.

<u>EDITOR:</u>

Arpad, you are correct. The Ws which is a partial dominant will only show when the bird is e//e either full color or dilute. The young come out of the nest rec. red and molt in the white side. This work was done in 1982 by Tim Kvidera. I rerun the tests in my loft. I found that it was as Tim said. The young molted in varying amounts of white depending upon whether they were hetero or homo for Ws.

I also investigated the black white shield. Contrary to some opinions, the gene that produces this phenotype is dependent upon the spread gene. Thus I produced the coloration in spread brown, spread bronze blues and spread rec. reds. The shield mark is present in the juvenile feather and usually is accompanied by some white feathers around the head and upper neck on blacks. I was not able to clear up the shield to pure white on the other colors. The trait is also a partial dominant and even the homo white shield bird needs some feather plucking to clear it to white. The white feathers around the head usually disappear but may stay in the adult.

<u>JOE POWERS WRITES:19dec'08 excerpts and paraphrased</u>

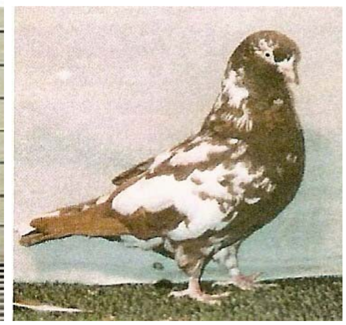
The Black Whitesides do not molt in white – they are patterned when they feather out. On page 45 of the November/December Purebred Pigeon is a picture of a black hen bred by Jimmy Raposa. She was bred out of a red whiteside X black self (which was bred out of a red whiteside X black self). He insists that she molted in her white pattern when she molted. In my lifetime of pigeons this is the first one I have seen or heard of. I bred LFCL Whitesides for many years. John Tidwell spent much of his life trying to make black whitesides that would molt in and never bred one.

The Whiteside (Ws) gene is a recessive gene and if one is breeding Classic Almonds and using some of the sub varieties, you will get some Rosewings. Working with them leads to Gay Mottles and then Whitesides. The Whitesides molt the white in from solid colored rec. red or yellow. They change some in their yearling molt as well.

EDITOR: **My research showed the Whiteside gene (Ws) to be a partial dominant that only expressed on an e//e phenotype. Also I found I could get the "Black Whiteside" to express on an e//e spread bird but it never was as easy to work with as the Ws gene. Both traits together produced gay mottled birds but I never achieved a clean shield on these birds.**

"black white shield" G^Ps on spread brown.

"Black white shield" on spread dilute bronze



Het. Ws and het "black white shield" on spread e//e.

EDITOR:

Steve and Rebecca Souza have written the following paper on a recessive opal allele. To bring this to focus pictorially, I will enter here pictures of recessive opals and the newly named mutant. The cherry mutant picture on the left is Steve's.

Recessive opal bar

recessive opal bar

recessive opal check

The cherry mutant

cherry with crop crescent

cherry checkered

Analysis of the Opal color variant of the domestic pigeon (Columba livia)

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ABSTRACT

Is there a gene present that is the causal agent for the Ash-red mimic in pigeons which seems to be a variant of opal? Hollander didn't think so (Hollander, pers. comm.), and no testing had been done to make a determination. We set out to do breeding tests, in individual pens, evaluating whether genetics could be the source of the phenotype in question. Our initial results suggested an allelic gene to opal was at the root. Additional breeding in numbers provided statistically significant results lending strength to the identification of a new (recessive) opal allele as the factor responsible. This ash-red mimic has been given the name "cherry" and symbolized as (ch). Offspring from a cherry x wild type mating were put back to the cherry parent with a result of 43% cherry young and 57% wild type young. We also determined cherry was a recessive allele to opal using complementation tests.

INTRODUCTION

The recessive opal gene in pigeons, most commonly found in homing pigeons, has generally shown two identifiable phenotypes. The one more frequently seen has been a quite variable effect referred to as chocolate or mosaic by homer breeders, and ultimately dubbed the "blue-phase" opal and symbolized (o) (Hollander 1938). Less often observed is an Ash-red mimic phenotype described variously as "extreme" opal (Hollander 1938), "reddish type" opal (Levi 1941:317), or "red phase" opal (Gibson 1995:81). This more stable consistent appearing phenotype has not been studied or tested previously.

Testing has shown opal to be a simple recessive, on the same chromosome as both the pattern series (c) and Spread (S) (Hollander 1938, Quinn 1971:55). The lighter Ash-red mimic phenotype occasionally seen on opal birds had not previously warranted serious study and was thought to be the result of a thyroid condition (Hollander 1938). What study was done on the "red phase" opal phenotype did not result in identification of a genetic source for the phenotype.

The purpose of this study is to evaluate the "red phase" opal phenotype to determine conclusively if it is the result of a medical thyroid condition, or is rooted in a genetic cause. Standard breeding tests intended to isolate any possible gene, or demonstrate that no gene cause is present, were used in this study to further the available information. As a result of our initial breeding data, testing was also done to determine if the potential gene was an allele of opal. This ash-red mimic has been given the name "cherry" and symbolized (ch).

METHODS

Background information: With a determination needing to be made as to if a genetic source vs. a medical source is the root cause of the phenotype being evaluated; the testing needed to look for an allelic gene to opal as one potential causal variable. Standard breeding tests (Mendel 1866, Levi 1941:301, Quinn 1971:108) were used with an emphasis on looking for allelism also.

Protocols: All breeding was done with pigeons (Columba livia) in individual breeding pens. First round eggs from new pairings were discarded to eliminate possible latent sperm held within the female. All pens were housed at the same location and afforded the same lighting and ventilation. All mated pairs were fed and watered from the same supply source.

In order to determine if the "cherry" mutant was the result of an identifiable gene, several matings were done with a cherry and a wild type pigeon, using both a cherry male with a wild type female, and a cherry female with a wild type male. The resulting F1 young were mated to each other, to cherry birds, and to normal "blue phase" opal birds. Opal birds were then mated to cherry birds to evaluate allelism using complementation. Finally, cherry birds were mated to birds which were heterozygous for both opal and cherry.

Data were summarized using n and mean with measures of variability reported with Standard Deviation.

RESULTS

Cherry has been noticed with curiosity for a number of years, primarily in homing pigeon flocks. Those who experience the occasional cherry bird also seemed to have some number of opal birds in their loft. The cherry phenotype is very consistent in color and form, unlike opal which shows extreme variability in its appearance (Quinn 1971). Cherry presents a smooth uniform ash-red appearance of the clumped and smooth spread areas of the feathers, while the course spread portions, when a wing pattern is present, are generally cherry / rose colored similar to the effect of $\mathbf{B}^{\mathbf{A}}$ on pattern.

Unlike opal, cherry is quite uniform from bird to bird with no noticeable variation in color or hue. The cock birds are strikingly good Ash-red mimics, while the hens are a slightly more grey / ash color but also maintain the overall uniformity from hen to hen. The cherry phenotype does not change from molt to molt, as Hollander noticed when discussing "Extreme" opal (Hollander 1938). Six and eight year old cherry birds appear the same color and configuration as when first feathered out.

Fig. 1 shows the outcome of mating homozygous cherry to wild type, with 100% of the young appearing as a wild type phenotype.

When mating F1 birds together **Fig. 2** illustrates the distribution of F2 approached the Mendelian norm for an autosomal recessive with 78% appearing as wild type and only 22% cherry young produced.

cherry mated to wild type	
total young	32
opal	0
wild type	32
cherry	0

Fig. 1

F1 mated to F1	
total young	18
opal	0
wild type	14
cherry	4

Fig. 2

When mating F1 birds (being heterozygous for cherry, and wild type) to homozygous opal birds, **Fig. 3** shows 45% of the young have an opal phenotype with the balance appearing as wild type.

Fig. 4 provides data on the reverse of the Fig. 3 process whereby homozygous cherry birds of both sexes were used to mate to birds that were heterozygous for opal and wild type. With a larger sampling of young, the resulting offspring were 50% opal, and 50% wild type phenotype. As in the previous testing (Fig. 3) the offspring of this mating process displaying an opal phenotype would be genetically heterozygous for opal and cherry, while those showing a wild type phenotype would be heterozygous for wild type and cherry.

opal mated to F1	
total young	20
opal	9
wild type	11
cherry	0

Fig. 3

cherry mated to het opal/wild type	
total young	46
opal	23
wild type	23
cherry	0

Fig. 4

When mating homozygous cherry birds to heterozygous opal/cherry birds, **Fig. 5** shows no young with a wild type phenotype. All birds produced were of opal or cherry phenotypes.

Taking F1 birds and mating them to homozygous cherry, **Fig.6** indicates an expected result given the previous data. All offspring were either wild type phenotype (57%) or cherry in appearance (43%). No young demonstrated an opal appearance.

cherry mated to het cherry/opal	
total young	17
opal	10
wild type	0
cherry	7

Fig. 5

cherry mated to F1	
total young	21
opal	0
wild type	12
cherry	9

Fig. 6

DISCUSSION

With the results of the various breeding tests concluded, it would appear that the statistical representation indicates that root source of the cherry phenotype is a genetic one, and not a simple random medical causation. Even if the phenotype had been caused by a failure of the thyroid gland, the failure would have had to have a genetic cause in order for typical Mendelian results to have been produced.

When mating a cherry bird (of either sex) to a corresponding wild type (+) all offspring (F1) produced were of a wild type phenotype. This would indicate that cherry was an autosomal and not a sex-linked gene. This being the case, the cherry phenotype birds will have 2 genes at the specific loci they reside on, both of them being the now described cherry (ch) gene.

To confirm the cherry gene is an autosomal recessive gene, we then mated the F1 young together. This produced young where 22% were of the cherry phenotype, and the balance (78%) appearing as wild type. The genes present at the opal loci for the non-cherry phenotype birds can not be determined without additional breeding tests on those birds.

Breeding opal birds to F1 (heterozygous cherry and wild type) birds produced only opal young (45%) or wild type young phenotypes (55%). Reversing the process and breeding cherry birds (homozygous for cherry on the opal loci) to birds that were heterozygous for both wild type and opal at the opal loci produced a 50/50 distribution of wild type phenotype and opal phenotype young.

This would indicate that birds which were heterozygous for cherry and wild type (as the F1 were, as well as the 50% wild type phenotypes shown in **Fig. 4**) would have no indication that they were not pure for wild type. In this way cherry acts as opal does, displaying no outwards appearance when in its heterozygous form. Conversely those young producing an opal phenotype as described in **Fig. 4** would have a genotype consisting of one gene for opal and one gene for cherry at the opal loci. This would suggest that opal and cherry are alleles, with opal being the more dominant of the two genes. When cherry has been present in domestic pigeon lofts, it is infrequent, and often mistaken for Ash-red. The lower frequency of cherry young in random breeding situations (especially in homer breeding lofts, where flying performance is the criteria, not bird color) would lend strength to cherry being recessive to opal.

Pairing homozygous cherry birds to mates with a genotype of heterozygous cherry and heterozygous opal at the opal loci produced no wild type offspring (**Fig. 5**). All young produced were either of an opal phenotype (59%) or of a cherry phenotype (41%). The 5% ± 4 deviation of statistical expectations can be attributed to the opal females being poor breeders (Hollander 1938) showing greater infertility and embryonic death than the hatchability of young of other colors.

The results shown in **Fig. 6** where cherry genotype birds were mated to F1 birds, continues to demonstrate cherry is an autosomal gene. The young produced were either cherry (43%) or wild type (57%). No opal phenotype birds were produced from this mating. Additional testing will need to be done to determine the fertility and hatch rate for both opal and cherry birds, but it is clearly not at 100% of eggs laid.

I believe additional breeding tests should be done with F1 birds to each other, and with birds heterozygous for cherry and opal among themselves, to determine more grounded statistics, and to help with the hatchability study mentioned previously.

This study and the results reported, demonstrate that the cherry phenotype is in fact genetic in origin, and is a simple autosomal recessive allele of opal, bringing to rest the question of a medical causation to the appearance shown by cherry birds.

ACKNOWLEDGEMENTS

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