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Genetics for Bird Breeders (II)

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By Peter R. Head

"Sex-linked" is an often misused and misunderstood genetic term, and really it is quite simple. The sex of any bird is determined by its possession of a particular pair of chromosomes, called the sex chromosomes. The cock bird has a pair of similar sex chromosomes, called "X" chromosomes and the hen has one of these and an accompanying dissimilar one called the "Y" chromosomes.

About 50% of the female egg cells contain X chromosomes and the other 50% Y chromosomes. All the male sperm contain X chromosomes. The sex of the offspring is determined at fertilisation when a sperm (always x) fertilises an egg cell carrying an X chromosome the resulting bird will be a cock X/X. Likewise when a sperm fertilises an egg cell carrying a Y chromosome we get X/Y resulting in a hen. So the chances of male to female are 50/50 either way.

Like genes, chromosomes are always in pairs, one half of the set coming from the cock's sperm and the other half from the female egg cells. These two halves combine and form the first living cell, which of course divides and multiplies until it grows into the finished product and hatches.

It must be remembered that X and Y refer to chromosomes, not genes. The genes are carried on the chromosomes. When we refer to a "sex-linked" bird, we mean one which carries its colour controlling genes on the sex chromosomes. Everything else is the same.

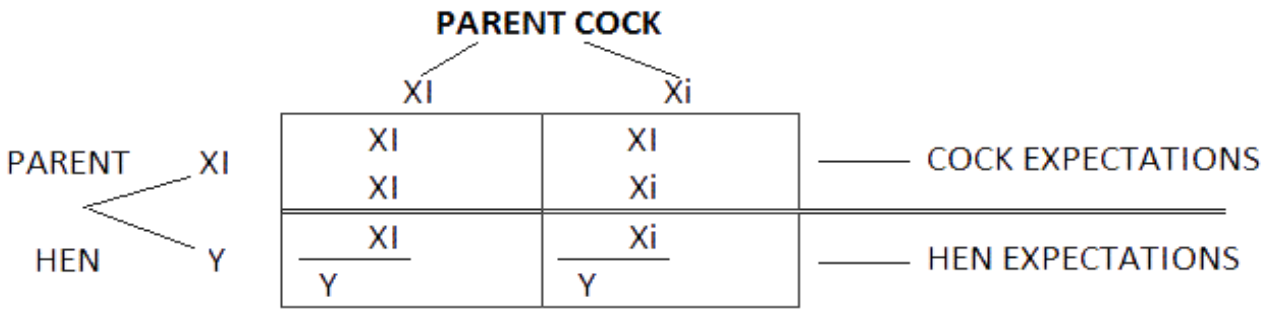
All known sex-linked genes are recessive, so that the only difference between the genes (apart from the actual colour) causing a bird to be blue or lutino, is that the lutino ones are carried on sex chromosomes and the blue genes are carried on some other pair of chromosomes. When I say "the only difference" I refer to the difference in breeding behaviour. Both birds still have the same number of pairs of chromosomes. (I believe Budgerigars have 13 pairs) and of course the blue bird still has sex chromosomes. Just to wander a moment, it's interesting to note that only birds and butterflies have male XX and female XY. I believe that other things, including humans, have male XY and female XX. Anyway, the colour genes of the sex-linked bird are carried on the sex chromosomes, but only on X chromosomes. As far as I can tell this is the only exception to the rule concerning pairs of genes, because the hen has only one X chromosome and apparently the Y chromosome has no gene carrying function.

Now the formulae.

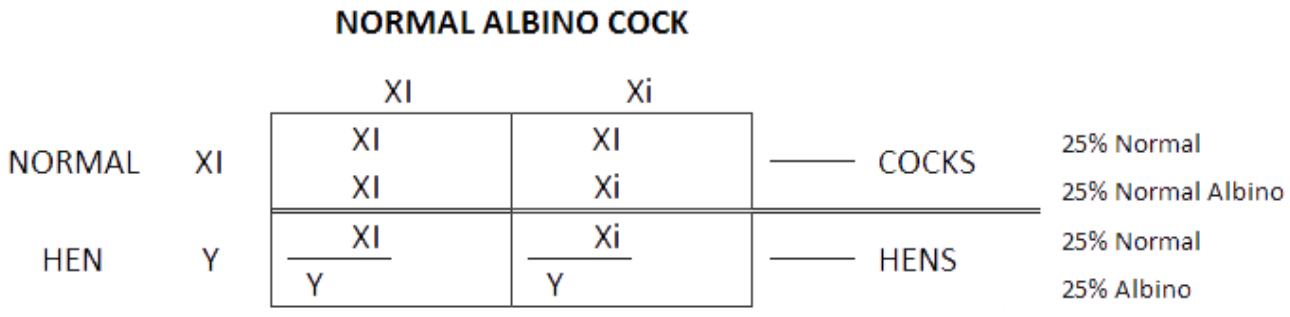
There are six established Budgerigar mutations which are sex-linked, but for now we'll interest ourselves with only two. Albino and Lutino. However these are really the same mutation.

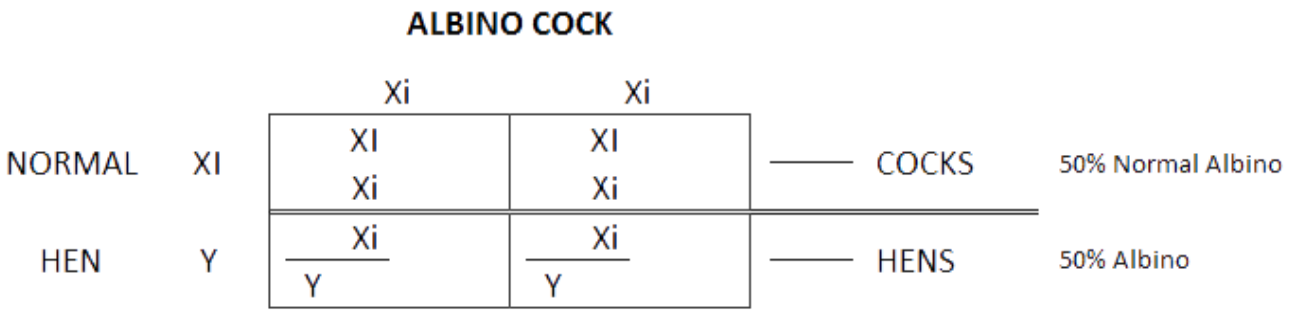
The effect of the "Ino gene" on a green bird produces lutino and on blue or grey gives albino. It all follows the same sort of pattern as the "dilute gene" which can produce yellow or white, depending on whether it acts on green series or blue series birds. Therefore with blue and lutino we could breed albino, etc.

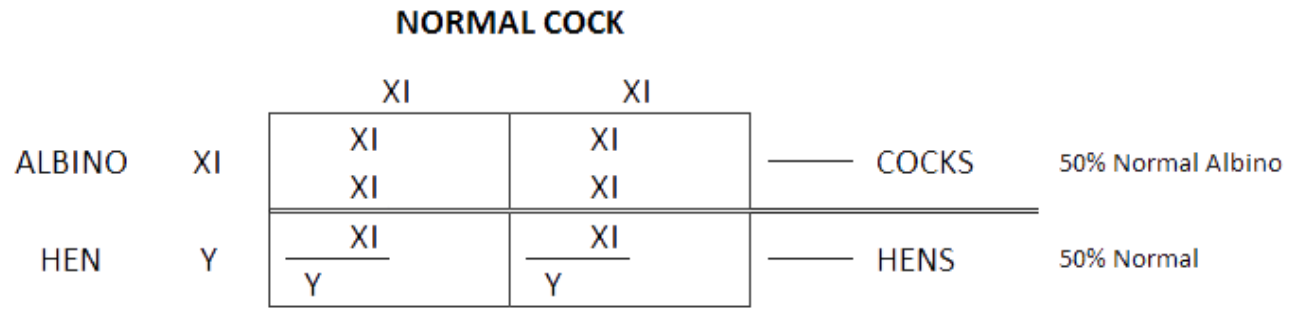
We shall use I or i to denote the Ino gene and its opposite. So with the Ino gene carried only on the X chromosome, the hen has a recessive Ino gene on the X and none on the Y making hen Xi/Y. An albino cock has recessive Ino genes on both so he is Xi/Xi. The normal cock has a dominant "non-Ino" gene on each X making him XI/XI. Likewise when discussing Ino mutations the normal hen is denoted by XI/Y. Now of course the only combination left is the cock with a dominant "non-Ino" (normal) XI overriding a recessive Xi which is a normal I split albino. You can see now that only two possible combinations exist with the hen, XI/Y which is normal, or Xi/Y which is albino. There with no other possibilities, she can never be split for any mutation carried on sex chromosomes, i.e. a sex-linked mutation. We can use a fairly similar system for finding the expectations from any sex-linked mating, as for the recessives.

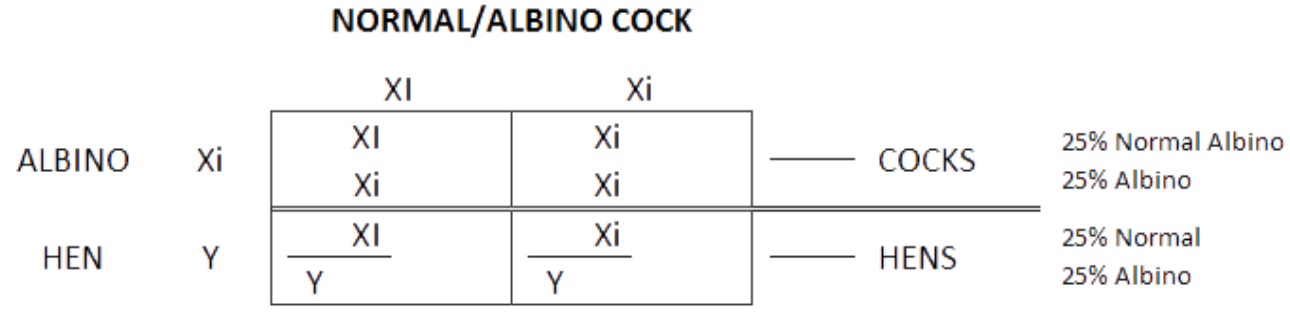


Above I have mated a normal/albino cock to a normal hen. XI/Xi mated to XI/Y. Always put the cock on top (easier to remember) and then the cock bird expectations will also be on top. With sex-linked expectations of course we are interested in sex as well as colour. So you can easily see from the above matings that we will get 25% normal cocks XI/XI, 25% split cocks XI/Xi, 25% normal hens XI/Y and 25% albino hens Xi/Y. There are a limited number of different sex linked matings as I have shown below.









ALBINO COCK

		Xi	Xi		
ALBINO	Xi	Xi Xi	Xi Xi	—— COCKS	50% Albino
HEN	Y	Xi Y	Xi Y	—— HENS	50% Albino

The five tables above will cover all the combinations and are correct for all sex-linked varieties.

The only other item which may be of interest at this time is the dark factor. I can't say just how it runs in peach-faceds. One would expect the jade to be a shade midway between normal green and olive, yet it seems to be closer to the normal than the olive. I haven't a great deal of experience with olives yet. Also I have seen great differences in the shades of olives, from a washy dark green, to other birds with dark almost black wings. Anyway the dark factor is semi dominant and as with most semi dominants is a colour modified rather than a colour.

We haven't really looked at genetic formulae for dominants (or semi dominants) yet, except to say to use the capital letters of the lower case letter used for the recessive mutation. When we are discussing a dominant mutation we use a capital letter, D for dark, but the small letter now means non-dark (or light) d.

Remembering that we will always have genes in pairs DD will be the dark shade, Dd the medium shade and dd the light shade.

Being a modifier it is added to the original colour formulae so that Bd/bd or Bbdd informs us that this bird is light green/blue.

Just for practice BDC/Bdc is jade/yellow, taking for granted that jade is the mid-colour in peach-faceds. So now any mating which involves depth of colour as well as colour can include D and d. In the jade/yellow formulae B/B tells us that it's a dominant non-blue bird, so it is green in colour, D/d gives us the depth of colour, middle, and C/c tells us the intensity, full colour split dilute colour.

You will notice that D/d is not dark.light. Nothing can be split for dominant or semi dominant. Dilute was a recessive modifier, dark is a semi dominant modifier.

The breeding results for dark and light are similar to the semi dominant pieds we discussed before.

Dark X dark gives 100% dark light x light give 100% light Dark x light give 100% medium. Medium x medium gives 25% dark 50% medium and 25% light.

Any others can be put across a square and worked out as shown previously.