

Understanding Color Mutations

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A growing host of new and exquisite Cockatiel color mutations and their myriad combinations are impacting Cockatiel circles both on and off the show-bench at a challenging rate. With such "rares" of yesterday now increasingly spotted at bird fairs, formally inscribed within show classifications, and currently rooted throughout classified advertisements, the contemporary list of new mutations continues to grow.

No longer are breeders confined to a world of a few simple sex-linked or autosomal recessive mutations. Now, the art of producing and combining such color combinations requires as much forethought as the painter's use of the palette. While some mutations may continue to mystify both the newcomer and veteran breeder, a few simple principles may provide insight and a clearer understanding of how such colors and patterns routinely operate.

Whenever instructing Cockatiel genetic workshops, I frequently recommend fanciers approach the subject by considering the big picture. Such an overview of genetic modes of inheritance, classifying mutations into subsets, or categories, often provides a rudimentary grasp, or "feel," for working with these mutations, understanding their basic strengths and weaknesses, and the manner in which they may be inherited.

This article series will focus on the standard varieties and current rares as set forth in the nomenclature commonly employed by U.S. breeders in both the American and National Cockatiel societies. While additional Cockatiel organizations are

currently forming around the globe, with many adopting their own show standards and nomenclature, the U.S. organizations have been in existence for nearly two decades, with classifications stretching as far back as the late-seventies and early eighties.

Dominant Mode of Inheritance

In Cockatiels, we have at present two distinct, dominant colors to consider. The first and more familiar is the nominate race, or wild Cockatiel of Australia, commonly referred to as the Normal Gray. In recent years however, the Dominant Dilute, more popularly known as the Dominant Silver, was bred in the United Kingdom. The Dominant Silver has the distinction of being the first *dominant* mutation ever to occur in Cockatiels.

Until very recently it was an accepted fact that all Cockatiel mutations were recessive to the Normal Gray. With the exception of the new Dominant Silver mutation, this rule remains true even today and no other color may dominate all resulting offspring produced whenever a Normal Gray is utilized, regardless of parental gender.

However, whether Dominant Silvers are currently available here in the U.S., or become available to breeders in the near future to produce the mutation in enough quantity for prices to drop, only time will reveal. I do believe, however, there is a strong likelihood we shall see other dominant mutations in the future, which should lend an even greater variety to the delightful color combinations

we are already beginning to see in representative numbers at shows, exhibitions and fairs.

Normal Grays

As the nominate wild type Cockatiel, the Normal Gray may be described as a solid gray bird, with white wing-bars, and carotenoid orange and yellow pigments coloring ear covert feathers, head and undermarkings. Males carry the full yellow face mask upon maturity, often with a deeper intensity to the orange ear covert feathers, which are more commonly referred to as the orange "cheek patch."

Although lacking the full yellow face mask, hens and unflighted young do carry some degree of yellow on the face, typically marking areas around the forehead, lores and beneath the lower mandible. Yellow spotting on the undersides of flight feathers, and yellow barring under the tail, are carried by both hen and young, while solid gray tail and flight feathers distinguish the adult males.

While some Normal Grays do vary in their intensity of dark factors, demonstrating shades of light, medium and very dark gray, it is not at all unusual to find variations of color depth within the same individual. Such variations within the same bird, however, are discouraged by National Cockatiel Society show standards, rewarding instead an even tone throughout the bird regardless of the presence or absence of dark factors.

Therefore, such an individual, be it either a solid light gray, a medium gray or a dark gray would be equally desirable, as long as the shade of gray remained consistent throughout. In contrast, during recent years the American Cockatiel Society revised its show standards, specifying all Normal Gray should be colored dark gray, while ideally carrying a uniformity of color throughout.

Dominant Silvers

During the early 1980s, the Dominant Silver made its appearance in the United Kingdom, originating in the aviaries of Mr. Terry Cole. As presented above, the Dominant Silver has the distinction of being the first, and only, dominant mutation in Cockatiels, and the first Cockatiel mutation to be produced by the United Kingdom.

By 1988, Cole bred the Dominant Silvers into many of the color varieties

including the Whiteface, which he has termed the combined form as Platinums. This could cause some confusion in international circles as there are already some U.S. breeders who refer to the Fallow-Recessive Silver, a double-recessive cross mutation, by the same name.

Interestingly, the Dominant Silver comes in two forms, the single-factor (SF) mutation, and the double-factor (DF) or dilute form. Single factor Dominant Silvers appear as a pastel-silver shade of gray, with a deeper shade coloring the area of the head and neck, creating the unique appearance of a "skullcap." In addition, true Dominant Silvers carry *black* eyes and *dark gray* legs, which easily distinguish them from the Recessive Silver mutation, which has dark plum to red eyes, lighter feet and a color range of steel or silvery gray, to fawnish brown.

Although indistinguishable upon hatching, Dominant Silvers can soon be identified from Normal Gray siblings once they start to feather, by their light gray, brownish-brick body color. In addition, the darker skullcap, dark gray pigmented legs and black eyes will already be evident.

Interestingly, after the first juvenile molt, cock birds acquire the more silvery gray plumage, while hens maintain their original color, although perhaps a bit brighter, and grayer. Over the years, Cole has succeeded in selectively breeding hens which are much lighter and therefore more similar to cock birds. Currently, however, Dominant Silvers in the U.K. vary quite a bit in their dilution of gray melanin, especially in single-factor birds. The similar goal of breeding for a consistent shade or depth of color, is recommended.

Double factor Dominant Silvers are a dilute form of the single-factor variety. Such birds appear almost as light as a Lutino, with the addition of a subtle light gray wash throughout. Once again, double-factor Dominant Silvers carry the darker skullcap, dark legs and black eyes. of their single-factor counterparts.

Understanding Dominant Inheritance

For the first time, Cockatiel breeders may indulge in another mode of color genetic inheritance, such as Budgerigar and Canary breeders have been using for

decades when working with dominant mutations. As the mode of inheritance suggests, dominant forms may color or mask any other color mutation. For example, when a Normal Gray is paired to a recessive mutation, the Normal Gray masks recessive colors in all offspring, producing heterozygous individuals which only carry the recessive mutation in hidden form, which aviculturists typically refer to as "splits."

Considering the Normal Gray once again, when paired to a sex-linked mutation, Normal Gray may mask a percentage of sex-linked recessive mutations in some offspring produced. Depending upon the gender of the sex-linked mutant parent, some percentage of offspring may visibly show the sex-linked mutation, while other male nestmates may be split (heterozygous), carrying the sex-linked trait in hidden form. In some instances a percentage of offspring may be pure homozygous, e.g. Normal Gray, completely lacking the sex-linked mutation in either visual or hidden form.

Whenever working with a dominant mutation such as the Dominant Silver, pedigree cards become relatively simple to fill out, as either a bird is a Dominant Silver, or it is not. Since a bird can never carry a dominant color in hidden form, a bird can never be heterozygous, or split, to Dominant Silver. Nor, by the same principle, could a bird ever be split to Normal Gray. It is either a Normal Gray, or it is not.

Dominant Silvers add a further dimension to color genetics with single- and double-factor inheritance. Pairing a single-factor Dominant Silver with a Normal Gray should yield equal numbers of Dominant Silvers and Normal Grays in the first generation. Pairing a single-factor Dominant Silver with another established mutation, will yield a percentage of Dominant Silvers split (heterozygous) for the other mutation, much in the same manner as when working with Normal Grays.

Pairing together two single-factor Dominant Silvers will yield a 1-2-1 ratio, producing a preponderance of single-factor Dominant Silvers, along with a lesser amount of double-factor Dominant Silvers, and birds which neither carry nor are visible for the Dominant Silver mutation.

Once acquiring a double-factor Dominant Silver, and pairing it to a non-

Dominant Silver, the resulting offspring will all be single-factor Dominant Silvers. When pairing a double-factor Dominant Silver to a single-factor Dominant Silver, the cross should produce an equal amount of single-factor, and double-factor, Dominant Silvers.

Lastly, when paired to each other, double-factor birds reproduce themselves, and all double-factor Dominant Silvers will result. The accompanying table lists the reproductive behavior of Dominant Silvers and their overall percentages. Percentages, as always, are based on every 100 birds produced and should even out to such numbers over time and with enough chicks bred.

Future articles on Cockatiel color breeding will continue with a discussion on the autosomal recessive mutations, and sex-linked recessive mutations, in standard and rare color varieties of Cockatiel mutations.

Breeding Expectations for Dominant Silvers

PARENTS:	OFFSPRING:
Single Factor x No Factor	= 50% Single Factor 50% No Factor
Single Factor x Single Factor	= 25% No Factor 50% Single Factor 25% Double Factor
Double Factor x No Factor	= 100% Single Factor
Double Factor x Single Factor	= 50% Single Factor 50% Double Factor
Double Factor x Double Factor	= 100% Double Factor

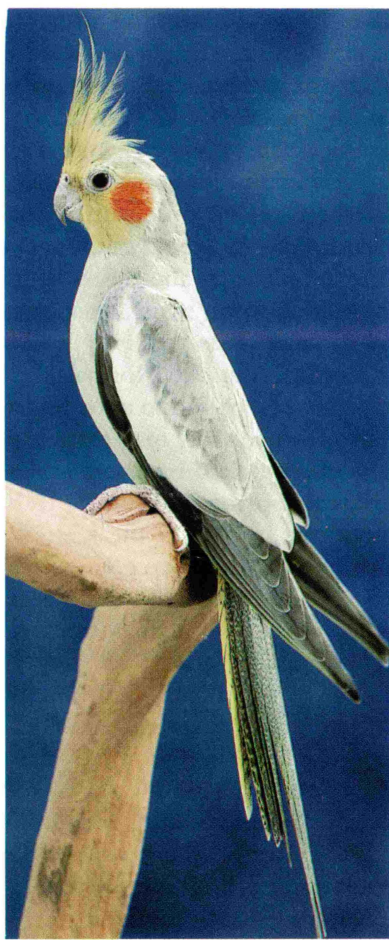
NOTE: It may be inadvisable to combine the following color mutations with Dominant Silvers: Lutino, or Whiteface-Lutino (i.e., Albino), which might work to mask the Dominant Silver; Cinnamon or Fallow which may further dilute or modify Dominant Silver; and Recessive Silver which would initially be carried as a recessive. Until more is known on how such colors interact, it may be wise to only cross Dominant Silvers with Normal Grays, Pearls, Pies, and Whiteface (i.e., Platinum) combinations.

References

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Recessive Silver male.



Recessive Silver hen.

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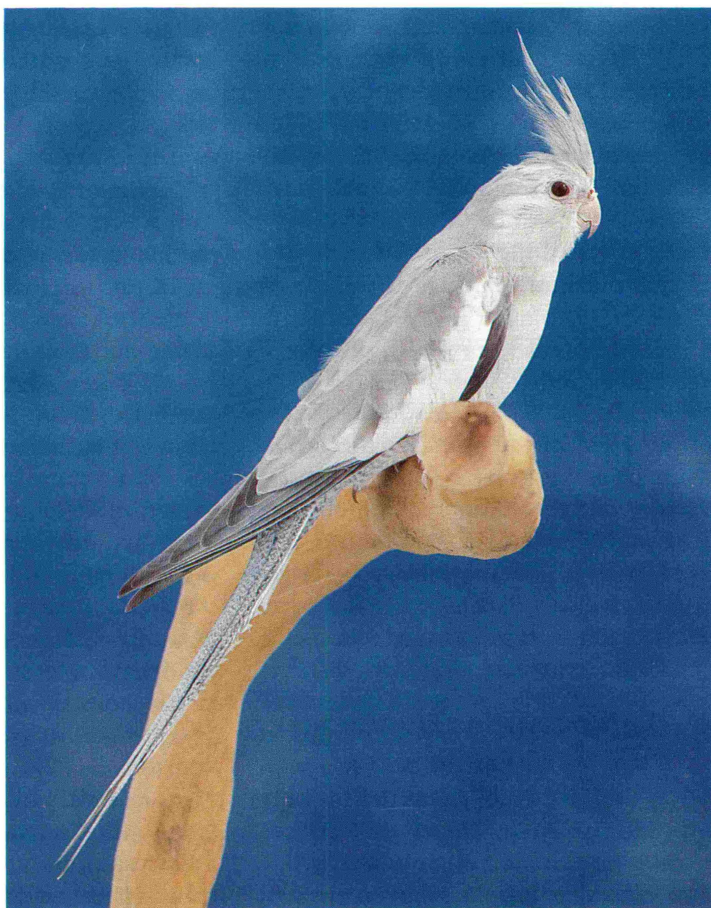
Cockatiel Connection Mailbox

Last fall I purchased a young Pearl-Pied hen. She was quite lovely, but imagine my surprise when she molted and her new feathers on her head came in orange! It is the same marigold orange as her cheek patches. The orange feathers are mingled with the yellow feathers on her head. They extend from her beak, through her cheek patches and around the nape. She has a beautiful dark yellow crest, a pale lemon yellow and white body with pale gray pearling.

She and her mate are now raising their second clutch. Some of the babies are showing orange feathering. I plan to keep them until their first molt. Nobody I have talked with has seen a Cockatiel with this kind of coloring. Do I have some kind of new mutation? And, if I do, how



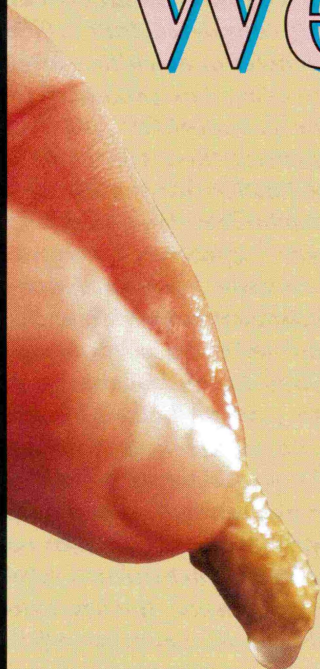
Head study of Normal Gray male with standard cheekpatch.



Whiteface Recessive Silver hen.

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should I proceed with my breeding program? Thanks for any help or advice you can give me.

Sincerely,
L.S.
Mt. Airy, MD

Dear L.S.:

It is always exciting to hope one has a new mutation. Many times, however, breeders are disappointed to learn that such new variations either do not endure throughout the lifetime of the bird, or that such affected individuals are unable to reproduce these colors and markings in their offspring.

It certainly is not unusual for Cockatiels who are going in and out of breeding condition to exhibit a temporary "bleeding cheek patch," or orange carotenoid pigments stretching beyond the parameters of the cheek patch, marking the face, neck and head. Such reports are, however, more often cited in males. Yet the question of some offspring continuing to exhibit such markings still remains, and needs to be carefully considered.

Generally speaking, a new mutation is present from the time of birth, and does not suddenly disappear or reappear with the onset or conclusion of the molting process (with the exception perhaps of melanistic phases or seasonal plumage changes, which we generally don't deal with in Cockatiels).

One factor to consider in the sudden appearance or alteration of color and markings in young and mature birds is the role nutrition may play. Some species of birds such as colorbred canaries, flamingos and others, can be colorfed. Such species are intensely affected by the addition of carotenoids (e.g. carrots, beta-carotene, etc.) to their diet to enhance their coloration. It is also a possi-

bility that in some instances colors and markings might be affected by the lack of or the inability of an individual to successfully metabolize specific nutrients in the diet.

Some years ago "Zebra Cockatiels," so named for the reduction of gray melanin pigment which resulted in the appearance of yellow or white striping breaking along gray feathers, caused quite a stir of interest. For a short time the pattern was hastily considered as a possible new mutation until it was found such birds were unable to reproduce similar markings in their young. These birds were rightfully regarded as "sports," rather than valid mutations since they were unable to consistently reproduce such markings and patterns in future generations.

"Zebra Cockatiels" were eventually documented in literature as having been caused by a nutritional break during the pinfeather stage. The subsequent loss of markings occurred around six months of age, with individuals continuing to cycle in and out of color. The markings were never found to be permanent, but instead were eventually lost at maturity.

Unfortunately, your letter did not mention the percentage of young Cockatiels affected by the extended orange coloration, whether such markings were initially present once chicks feathered out, or offer a description of the color and background of their sire, so I can only speculate in generalities. However, I do believe you are wise to keep such youngsters through the juvenile (and adult) molt to learn if such markings are retained.

Over the years, breeders in the U.S. have heard rumors of Cockatiels originating in other countries with coloration ranging from orange-headed varieties to nearly completely orange colored birds.

Whether such birds in actuality even exist has never been satisfactorily documented Stateside. The most obvious method of producing such a variety would most likely occur through an unplanned, spontaneous new mutation appearing in the nest, or through years of dedicated, methodical, selective breeding of a birds, or birds, sporting such anomalies.

Breeders who have practiced selective breeding know that if one wishes to enhance a specific existing trait, or other inheritable features, one must carefully "select" and work with individuals who exhibit the considered trait. There are many examples in aviculture where selective breeding has produced or improved a new mutation.

In Cockatiels, there exists numerous stories of fanciers attempting to selectively breed birds ranging from "orange-laced pearl" specimens, to entirely "green," or even black cockatiels. Of course, such descriptions are only as accurate as the breeder's account or report.

Meanwhile, I would encourage you to hold onto your unflighted birds until after their complete molt. If they retain their color, you might try breeding back the more extensively marked offspring to its opposite sexed parent for confirmation to learn if such a trait is inherited in the first generation. It is best to forego any brother to sister matings, especially when working with new unproven mutations, which do not benefit from such close inbreeding practices.

Try to utilize homozygous Normal Grays when at all possible, to prevent other color mutations from masking or modifying the new alleged mutation. Matching the best colored individuals with large Normal Grays, aids in retaining size, vitality and fertility in future bloodlines.

Should your youngsters retain their markings into adulthood, I would strongly recommend you consider linebreeding, the systematic breeding back to distant relatives to set the color in one or more bloodlines. Should your alleged mutation prove true, I would be happy to recommend specific linebreeding techniques for you to follow when your youngsters come of breeding age.

Questions on Cockatiels may be sent to: Linda S. Rubin, A.F.A. contributing editor on Cockatiels, c/o the A.F.A. Business Office. Letters will be answered in future columns. ●



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