photo by Warwick Remington

Australian Platinum-Pearl hen on right (notice the dark melanin coloring the primary flight and central tail feathers).

Notice the retention of the white wing bar on the Whiteface version of the new, darker U.S. mutation.

photo by John Mason

A pair of the new U.S. mutation, hen above, cock below.

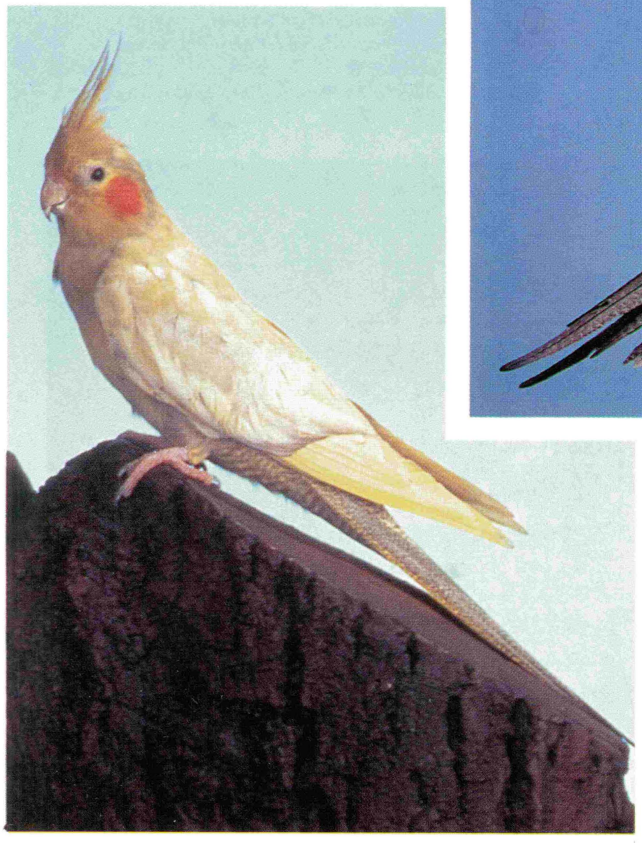
photo by John Mason

Whiteface version of the new darker U.S. mutation.

photo by John Mason

New U.S. mutation hen has darker pigment on the breast and undersides (including rump), with a near to complete reduction on the wings and flight feathers.

photo by Lloyd's Photography



Australian Platinum cock is pigmented darker on the back, and wings, with a near to complete reduction on the breast and undersides. Flight feathers are also colored by dark melanin pigment.

photo by Warwick Remington

GENETICS FOR AVICULTURISTS

New U.S. Cockatiel Mutation and its Genetic Nomenclature

by Linda S. Rubin, Chestnut Hill, MA

News of an apparently new mutation in Cockatiels has riveted avicultural circles, enthralling color breeders everywhere across the United States. The new mutation, or mutations, also appear to have a modifying effect upon existing color varieties as did the Whiteface mutation some 15 years ago. Whether it is an individual spontaneous mutation, or recombinant form, i.e., cross mutation(s), remains to be proven through detailed, vigorous and objective record keeping. However, those who can afford the new variation are now acquiring the birds, and as with any new variety in demand, the supply is limited and prices will be high for some time.

Understandably, not much is actually known about the new mutation either in its genetics or mode of reproduction. Yet, its effect on longtime color breeders has been invigorating. The problem, however, with writing about a possible new mutation is that until all the facts are in, only theory may be offered. Unfortunately, such facts may take years to accumulate and there is no easy "quick fix." However, the comments offered below will perhaps shed some light on the subject and will hopefully be construed as helpful, until more is known. Certainly, additional facts and new information will have a direct bearing on how we later evaluate this possible new mutation and what it will be called.

American Standard

An attempt is currently being made by some U.S. breeders to assemble an American Standard of Nomenclature. The goal is to construct a list of genetically correct labels (i.e. nomenclature) to name mutations which will be applicable to all species of birds. For example, a Fallow mutation will be called a Fallow, whether it occurs in Cockatiels, Budgies, parrots, or any other species of bird. This effort is long overdue and even the order in which the mutations are listed will be organized.

For Cockatiels, the national specialty societies, such as the American Cockatiel Society and the National Cockatiel Society, will have excellent input into such an effort. It is crucial that aviculture select the correct nomenclature (recognized by aviculturists both nationally and internationally), in order to avoid the errors and confusion which have occurred in other species of birds, especially with the increase of new mutations on the rise.

Genetics

In avian genetics it is generally understood that green carotenoids are not present in the structural colors of birds. Rather, bright green may be produced when a particular carotenoid pigment first aids in the absorption of short-wave radiation from white light, and scatters the remaining light in the end of the color spectrum allocated for green. The dull and olive green colors are usually produced by an interaction between melanin and xanthophyll pigments.

A common occurrence in avian color mutations is the process of schizochroism, or split color, as in the sense of "cloven." This is not to be confused with the avicultural term "split," or the geneticist's term heterozygous. In some birds, schizochroism may occur involving two different pigments which may overlay one another within the same feather.

A schizochroic mutation could account for both the lighter phase of the new U.S. color and the darker (or dark factor) variants. It is tempting to speculate that perhaps xanthophylls may be underlying (or overlying) melanin pigments, e.g., phaeomelanin (brownish pigment) which, when coupled with normal light scattering in structural colors, produce the appearance of green. Theoretically, such pigmentation could be responsible for the partial olive green appearance in some of the new U.S. mutations which are especially dramatic when viewed in direct sunlight.

Color Pigmentation

There has been some speculation that the new U.S. mutation may be the result of a Dilute. Unfortunately, the term "Dilute," or dilution, is poorly understood among aviculturists as is the mechanism of schizochroism. Geneticists generally have a stricter definition of the term "Dilute," which requires a bird to exhibit an even reduction in the quantity of pigment, resulting in a marked reduction in color intensity throughout the body. (The key to dilution is the uniform reduction in both the quantity and intensity of all color pigments present.)

While any bird may be affected by dilution, the definitive clue is that all colors and patterns are still present, but in faded condition. While one might wish to debate the point in the lighter colored birds, a dilute factor does not appear to significantly effect the yellow or orange carotenoids in the face, crest, or cheek patch, in either the lighter or darker varieties. Rather than appearing significantly faded as would be expected, the intensity of the yellow mask and orange cheek patches appear to be similar to their Normal Gray counterparts.

Another mechanism which should

not be discounted is the possibility of color modifiers, more specifically, adherent colors. Such changes can occur from either pigmented, or unpigmented substances laid on top of feathers. There is not much known about this mechanism in scientific circles but there are many references among aviculturists, the author included, when explaining some alterations in color mutations.

The definitive solution to the problem of correctly identifying the new mutation will come when formal analysis is rendered by examining feathers from all the variant colors under the microscope. This is more difficult than it sounds, as the only qualified individuals are molecular geneticists and properly credentialed scientists with a Ph.D. in genetics, rather than aviculturists. There are also very few avian veterinarians who have further training and credentials in molecular genetics, since genetic research is usually focused on more lucrative markets as dogs and cats (e.g. hip dysplasia, etc.). Currently, attempts are being made to seek out such trained, credentialed scientists, as any other researcher would lack the knowledge, professional training and impartial bias to fully understand or interpret the results.

Meanwhile, it is critical that all aviculturists working with these birds keep detailed, accurate records so that data can be compiled which may shed some light on the mode, (or modes), of reproduction. The author is also starting to work with these birds and is willing to act as a central "clearing house," to receive data from other breeders which will be compiled and distributed to all who participate in the long-term study.

Australian Mutations

There has also been some speculation that the new U.S. mutation could be the same variety as the two Australian mutations, the Platinum, and the Recessive Silver Spangle. Initially, one could certainly find them quite similar, however, closer inspection appears to reveal some differences.

Dissimilarities in the sex-linked Australian Platinum include: a more solid, smokey-gray body color with smokey-gray pigment coloring the primary flight and central tail feathers; yellow carotenoid pigment appearing more clearly through the body (e.g. non-schizochroic); and the Australians' observation that only males darken in color with maturity (the U.S. mutation includes several deeper shades which color either sex from birth).

The Australian Recessive Silver Spangle is difficult to compare to the U.S. mutation, which the author has only seen in the Whiteface variety. However, one major difference, at least in the Whiteface dark variety, is the retention of the cockatiels' standard white wing bar which the Recessive Silver Spangle reportedly lacks, or at best, is colored Silver. This could indicate the new U.S. mutation(s), and the Australian mutations, are unrelated.

A Possible Pastel

Meanwhile, the avicultural community is faced with the difficulty of naming the new mutation, or mutations, in keeping with the American Standard of nomenclature. This poses a problem, since it is also likely that whatever name we choose now could still be changed or augmented, once we learn more about the mutation, how it is inherited and the manner in which it interacts with other color mutations. Yet, a possible "category" of where the bird might fit, could also be considered.

As discussed above, a true Dilute is defined as a bird which demonstrates a uniform reduction of color in strength and force, resulting in the faded condition of all pigmentation. However, the term Pastel, at least as used among aviculturists, covers a wider area in many species. Although often expressed as a softer, partially reduced shade, Pastels do not necessarily lack intensity.

For example, in Budgerigars the pastel form of the Normal Green series birds are the Yellows and the pastel form of the Blue series birds are the Whites. Both the Yellows and the Whites occur in the three forms involving dark factors. In the White series, the colors include: White Sky Blue (no dark factor); White Cobalt (one dark factor); and White Mauve (two dark factors). Such birds are a softer shade but pigment reduction is not necessarily severe, varying from Light to Deep Suffusion. Additionally, one could reasonably argue that the family of Yellows are far from insipid, and occur in the corresponding three varieties of dark factors: Light Yellow (buttercup), Dark Yellow (deep buttercup) and Olive Yellow (mustard) as described in the American Budgerigar Society Standard of Perfection.

Another illustration of Pastel may be found in the Indian Ring-necked Parakeet. For example, the Pastel Blue or Blue-Turquoise, either alone or in cross-mutations, does appear to present a reduced rather than dilute result, in all it's combination forms. Of significant intrigue, the Blue Pastel, or Blue-Turquoise, appears to be the pastel equivalent of the White Sky Blue in Budgies. Pastels may also be found in many other species of birds.

Along those same lines, what would be the pastel form of the Normal Gray Cockatiel? Some feel the Normal Light Gray, which many of us consider simply as a bird lacking dark factors, is the pastel form of the Normal Dark Gray (e.g. a one dark factor Medium Gray, or two dark factor Dark Gray). However, it is more likely that the Recessive Silver, a red-eyed dilute mutation with a significant reduction in melanin pigment (also exemplified by the red eyes), would probably be considered more a true dilute, than a pastel.

The Fallow is another mutation with a reduction in melanin pigmentation, although like the Recessive Silver it appears to vary according to species, and in some, according to dark factors. In Budgerigars, both the Red-eyed Recessive English and German Fallows are more pallid colored birds which retain dark brown (rather than black) markings. In true Dilutes, the dark brown markings would be much reduced to more faded, and correspondingly lighter, shades.

Today, there are some Budgerigar breeders who recognize a form of Cinnamon Pastel (i.e. Cinnamon Whites of Light Suffusion), and a Pastel Fallow which retains only twenty percent depth of its original body color (e.g. quantity of pigment) due to the increased dilution when combining

Fallow with Pastel, which would put one more in mind of a true Dilute.

It is important to understand that not all forms of Fallow will appear exactly alike, owing to permutations in different pigments and variations found in each species. What is important to understand, is the manner in which Fallow would appear for that species.

This reasoning may be applied to other mutations commonly worked with in aviculture (e.g. Pastels, Dilutes, Inos, Pieds, etc.). It is the manner in which these mutations appear for a particular species which should be considered when assigning formal nomenclature. A thorough study in the pastel forms of color mutations, dark factors, degrees of suffusion and color pigmentation and their mechanisms, as appropriate for each species, is central to understanding their application. Not only for Cockatiels, but for all species of birds.

Breeding Results

Breeders who have produced offspring with the new U.S. mutation have reported a potpourri of results. What remains consistent are the uniform descriptions, including the perceived "yellow" pigmentation which is often seen as a dull "olive green," especially when viewed in full sunlight. There appear to be at least three shades to this mutation ranging from "light" to "medium" to "dark" possibly expressed by the absence or presence of dark factors.

A few breeders have reported the appearance of a "skullcap" much the same as seen in the United Kingdom's Dominant Silvers. It has therefore been suggested that perhaps Dominant Silvers play a background role, or that the new mutation itself may be solely responsible for its appearance. One astute, well-known color breeder has commented that when the Pied mutation is introduced, it appears to eliminate any evidence of a skullcap.

Offspring produced from the new mutation have been described as expected, although there have also been reports of red-eyed, lighter colored birds with the "greenish tint," beige colored birds with a skullcap, Normal Pearls, and some Fallows appearing in the nest, depending upon the matings. If this becomes consistent, we might have to reevaluate the possibility of the Australian mutations, or perhaps a similar mechanism, although even the Australian mutations are not well understood at this time. However, it is difficult to comment without actually viewing such birds first-hand.

From a genetic point of view, even the Australian Platinum might be considered a Pastel rather than a Dilute. In addition to their phenotypic (outward) appearance, when the Australian Platinum combines with other colors which increase dilution (e.g. Cinnamon, Recessive Silver, etc.), they are reported to produce a more faded, diluted visual phenotype.

Pastels of Light, Medium, and Dark Suffusion

Although there are no easy answers, it does appear the mutation is affected by at least three variations which could be due to the absence or presence of dark factors. This would account for the light, medium and darker variations consistently found in adult birds and offspring. In addition to dark factors, birds may experience color suffusion to different degrees.

However, there has been some speculation that other established mutations might be involved, if not directly, perhaps as precursors or in combination form in some ancestors. This is not an isolated theory, as many Budgerigar breeders can attest to in the production of different color types (e.g. the Greywing's link with the Clearwing; or the Recessive Pied's involvement in the production of Dark-eyed Clears, etc.).

One such idea is that Fallow, and/or the Recessive Silver may be involved. The U.S. Platinum is genetically a cross mutation of the Recessive Silver-Fallow. The Fallow's pallid color and yellow carotenoids may play a factor in earlier generations. Likewise, the dilute effect of the Recessive Silver, when combined with Fallow, might play a part in birds of Light Suffusion. Others have speculated the Dominant Silver, or another mutation with intermediate dominant inheritance (i.e. incomplete dominance), may be

responsible and give rise to single and double factor birds, which could account for different "shades" in appearance. No doubt, time will answer these suppositions.

Whether such mutations are involved directly, indirectly, or not at all, we do not know at this time and I suspect we won't know the answer to these questions and others, for many years to come. However, as the birds can be reproduced, it appears we do have a new mutation, or mutations, in Cockatiels and that should cause in even the most half-hearted observer of Cockatiels an enthusiastic response when viewing such eye-catching and intriguing results.

Nomenclature

While the author has discussed the category Pastel, the reason for singling out such terminology is to conform to existing avicultural nomenclature, at this point in time. While the term, Dilute, is also accepted nomenclature, it must be pointed out that often times it is assigned erroneously and is in many instances genetically inappropriate. Clearly, it will remain to be seen if we choose to use such terms or if, instead, other names are selected.

In addition, we now have the United Kingdom's Pastelface in the United States, and special care must be taken to call such birds by their correct name if we are to refer to the categories Pastel or Suffused Pastel to describe a bird which is genetically different. Should breeders refer to the Pastelface as "Pastels," it will certainly lead to confusion between the two varieties. Should another name be chosen to describe the new U.S. mutation, then, obviously, this will not be a problem. However, it does seem likely that we will want to reserve the term Pastel for future use, so it is probably best that fanciers use correct nomenclature so confusion is kept at a minimum.

It must also be emphasized once again that the most accurate solution to determining whether such color mutations fit various descriptions (e.g. pastel, dilute, schizochroic, adherent colors, etc.) is to seek out a trained geneticist to comparatively examine feathers under a microscope and formally document the results. To the best of my knowledge, this has yet to be done.

The Author in Australia

This past spring, the author was invited to speak in Brisbane and Sydney to the Australian National Cockatiel Society and the Native Cockatiel Society of Australia, respectively, and tour a number of top aviaries. This invitation marks the first opportunity for a U.S. Cockatiel color breeder to be able to view the Australian mutations in person (since Australia has had a ban on exporting their birds for a number of decades) as well as compare them to European and U.S. Cockatiel mutations, including the new U.S. varieties.

It is indeed unfortunate that one or more articles have appeared by some authors who have not even seen the Australian mutations, proclaiming them to be identical to the new U.S. mutations. This is another example where "being first to report," does not always guarantee accuracy.

There are now a few color specialists starting to report their results of working with the new U.S. mutation and feel the variety, or varieties, may act as an autosomal recessive in inheritance. One breeder has reported to this author that pairing one "light" and one "medium" colored bird of the new U.S. mutation has produced all three color shades, including the darker variety. Such results caution a more careful approach when attempting to explain their genetics. Interestingly, Australian breeders of the Australian Platinum, and the Australian Recessive Silver Spangle, feel their birds are two distinct mutations, inherited by sex-linked, and as autosomal recessive modes, respectively.

Careful documentation and comparisons, coupled with accurate breeding results of the new U.S. mutation(s), should hopefully decipher any speculative theories or future misidentification that is so easy to make with this intriguing color change. More importantly, future breeding records will serve to either correct, reinforce, or reaffirm the genetic basis in the ultimate naming of this excitingly different new mutation, or mutations, which hopefully will abide by correct genetic nomenclature in its naming. This is, after all, the practice of good aviculture. For all concerned. Both at present, and in our future.

The author is currently working with four pairs of the new U.S. mutation and its combination forms which will be set up in the spring. Anyone working with the new mutations who wishes to participate in the study can send their breeding results to:

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Chestnut Hill, MA 02167
Fax 617-469-0368

Please include detail of pedigree back to grandparents on both sides if known.

Author's Acknowledgment

The author wishes to express special thanks to Margie Mason, for supplying the color slides on the new U.S. mutations to accompany this article. Although first seen publicly in 1995 at the National Cage Bird Show, Margie Mason established the U.S. mutation in her aviary and has been working with it over the past 10 years, breeding it into many of the standard color varieties.

The author also wishes to extend a special thanks to Australian aviculturist, Warwick Remington, who photographed the Australian Platinum Cockatiels bred by top Australian Cockatiel breeder, Mike Anderson, of Queensland.

Linda S. Rubin has self-published several books including a workbook on cockatiel genetics and has over seventy articles on color pigmentation published overseas. She currently serves as the coordinator for the Committee to Establish U.S. Standard Mutation Nomenclature in Parrots.

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