Multiple *z* Alleles

By W. F. Hollander

Mendel identified pairs of "contrasting characters" and theorized that "determining elements" were their basis. He gave them letter symbols, such as *A* and *a*, the capital signifying dominant and the lower case the recessive. Each parent would contribute one, so the fertilized egg would have two, either *AA*, *Aa*, or *aa*. Simple! and no more babble about "blood".

Professor William Bateson in England about 1900 got enthused about this sort of gambling theory of heredity (he had Mendel's German translated into English), and promoted it. In 1906 he proposed the name Genetics for the growing science of heredity and variation, along with a number of other dignified terms: allelomorphs, homozygous, heterozygous, F_1 , F_2 , etc. Allelomorphs means alternate forms, the contrasting characters of Mendel, *A* and *a*. Homozygous means alike together – the fertilized egg has *AA* or *aa*. Heterozygous means different together, *Aa*.

Genetics soon became an active field of research, and exceptions to Mendel's theory appeared. Dominance was often incomplete, and instead of simply two alternate forms there might be three or more. But a fertilized egg should get only two.

Triple allelomorphs were first reported in pigeons and doves by L. J. Cole and his students by 1930. Symbols were a bit of a problem, as well as sex-linkage. Well the third allelomorph was given the same base letter as the others, and a special superscript (example B^A). Next came the pattern series in pigeons with at least four allelomorphs, and the almond color series.

About this time geneticists adopted the term **allele** as an abbreviation of allelomorphs. Also it was found that using the normal wild type of the species as a standard of reference is very helpful in figuring out the "action" of the genes (phenogenetics). For convenience the wild-type genes (alleles) all got identified with a "+" symbol, usually as a superscript.

Several more multiple-alleles series have been found in pigeons, and more will undoubtedly be discovered. Genetics buffs should have an exciting experience working them out. One that is being played with now is the *z* (gazzi) series, which now includes the "pencilled" gene, according to some tests by Kerry Hendricks, Robert Mangile, Larry Chesling, and me. Originally the study of this gene by Mme. Francqueville concluded that it is a simple recessive and she gave it the symbol, *pc*. Later study by our editor indicated partial dominance: he said (1993) "Sometimes a pseudo white-bar is produced by the heterozygous condition", so he used the symbol *Pc*. That sort of whitening has been called "flash" by fanciers (see for example discussion in PGNV&C 72 by Lynn Kral and Tim Kvidera in relation to "tail-mark" (all-white except tail). They think tail-mark is a single-gene effect but did not investigate the possibility of allelism with gazzi or penciled, which I think is very probable. And in view of the generally intermediate phenotypes of heterozygotes between gazzi, recessive white, and penciled, I suspect that one more allele, almost like the wild-type allele, is lurking in various breeds, and may be the culprit giving the flash effect which Gibson got in crosses of penciled. I am on its trail, and hope somebody else will join in. Assuming that my hypothesis is right, we have at least six alleles in the z-series, and we can set up a chart of their various possible pair-combination as follows:

Intersections give: phenotypes of heterozygotes. Question mark means needs checking.

Alleles	Z^{+}					
Z^{+}	+	z^{fl}				
z^{fl}	+	undergrizzle?	z			
z	+	intermed.?	gazzi	z^{pc}		
z^{pc}	+	flash	intermed.?	pencilled	z^{tm}	
z^{tm}	+	Tail-mark flash	intermed.?	intermed.?	tail-mark	z^{wh}
z^{wh}	+	splash	intermed.?	intermed.?	intermed.?	All-white, bull eyes

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