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The Gene of Golden Plumage Colour Linked with Lower Fertility in Mangurian Golden Quail*

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Summary. Relation between golden plumage colour and lowered fertility has been found in quails *(Coturnix coturnix japonica)*. Golden colour of plumage is due to the presence of a single gene *G*, while its recessive alleles *gg* determine partridge-like colour. Homozygotic birds of GG pattern die during incubation.

Key words: Quail - Lethal Gene Plumage Colour - Fertility

Material and Methods

In 1970 our laboratory received the coloured quails from USA. Amongst them there were 5 pairs of Mangurian Golden quails of golden plumage colour. They were kept separately in 5 flocks. All the eggs were collected and incubated and 41 nestlings produced: 28 nestlings of golden colour and 13 of partridge-like, the ratio being 2,2:1.

Of this progeny, the golden birds were crossed with partridge-like quails importand from Japan, amongst which the golden colour had not appeared during 7 generations.

In the F_1 there were 117 nestlings: 63 golden and 54 partridge-like, i.e. 1,2:1 ratio. Out of these 63 golden birds the flock for further reproduction was chosen randomly and this system continued for each following generation. The splitting of plumage colour to golden and partridge-like colours was observed in each generation.

The partridge-like quails originated from golden parents and coupled between themselves gave progeny exclusively of partridge-like colour, so their further reproduction was abandoned.

Results and Discussion

In the investigated material of golden Mangurian Golden quails and of their cross with Japanese quail, only the golden and partridge-like colours were obtained, indicating that these plumage colours are alternative and determined by only one pair of alleles. The gene for golden colour was designated as *G* and for partridge-like as *g*.

After crossing Mangurian Golden with Japanese quails the ratio of these two colours in F_1 was 1:1. In the population of golden birds there are homozygotic and heterozygotic quails ($G^2 + 2\,Gg$) and the ratio of phenotypes in the progeny should be 2:1. In reality the ratio was 1:1 - so the parents of Mangurian Golden birds should consists exclusively of heterozygotes, as the phenotypic ratio is similar to the ratio of *Pisum* type heredity for crossing a heterozygote with recessive phenotype.

For further coupling the golden-plumage birds were chosen randomly so the population genotype should be $G^2 + 2\,Gg$. After coupling such birds among themselves the phenotypic ratio of golden to partridge-like quails should be 8:1 (of $4\,GG + 4\,Gg + 1\,gg$ genotypes in population). In reality this phenotypic ratio was always 2:1 (see Table 1). This can be explained if one supposes the golden parents to be exclusively of heterozygotic type *(Gg)* and the *GG* homozygotes are not to be reproduced.

This hypothesis was confirmed by the results of hatch analysis (Table 2).

At the same time as the reproduction of golden quails, the reproduction of 2 other coloured strains (black - British Range and white - White English) was carried on. They originated from the same farm as Mangurian Golden, were divided in the same way into separate flocks and were crossed once with the Japanese quail. Handling of eggs (storage, incubation, hatching) and all other environmental factors were identical for all birds.

In Table 2 the results of hatching of golden, black and white quails are compared beginning from F_2, i.e.

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Table 1. Results of reproduction and phenotype pattern in golden-coloured quails

Generation*	Phenotype pattern: golden (number)	Phenotype pattern: partridge-like (number)	Phenotype ratio: golden:partridge-like
P	28	13	2.2 : 1
F_1	63	54	1.2 : 1
F_2	48	25	1.9 : 1
F_3	74	37	2.0 : 1
F_4	81	35	2.3 : 1
F_5	55	30	1.8 : 1
F_6	87	44	2.0 : 1
Total (F_2-F_6)	345	171	2.0 : 1

* Scheme of matings:
P - Mangurian Golden × Mangurian Golden
F_1 - Mangurian Golden × Partridge-like
F_2-F_6 - Randomly chosen golden-coloured birds

Table 2. Comparison of hatching percentage for golden, white and black-coloured quail after one crossing with partridge-like quail (F_2 - F_6)

Generation	Number of incubated eggs			% hatching from incubated eggs		
	Golden	White	Black	Golden	White	Black
F_2	132	-	119	53.0	-	75.6
F_3	301	264	516	36.9	69.7	65.1
F_4	382	168	134	38.4	54.8	53.0
F_5	204	165	191	41.7	66.7	73.3
F_6	438	320	256	29.9	68.1	53.1
Total	1457	917	1216	$\bar{x}$: 40.0	65.0	64.0

after coupling the crosses (coloured strain × Japanese quail) between themselves. Average hatching percentage (calculated on the basis of incubated eggs) for 5 following generations was 40% for golden, i.e. about 25% less than the hatching percentage for white and black quails. We presume that this difference is due to those 25% golden *GG* homozygotes which are not able to develop normally and die during incubation.

A similar relationship between recessive white plumage colour and recessive lethal gene of lowered hatchability was observed by Dunn (1923) for Wyandotte hen. It was investigated further by Warren (1933), Hutt (1940), Cochez (1951), Jerome and Huntsman (1959), Smyth and Fox (1961), and Mérat (1964). Landauer (1967) also observed lethal embryo gene *(Cl)* in the flock of the black Cornish hen.

Our observations on the relation of golden plumage colour with embryo lethality seem to be the first as far as quail is concerned and they have been preceded by two similar observations on the hen.

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