THE COLOUR GENOTYPE AS PREDICTOR FOR PIGMENTATION OF THE ABDOMINAL CAVITY IN BROILER CHICKENS

El color del genotipo como predicción de la pigmentación de la cavidad abdominal de los broilers

La couleur du genotype comme prédicteur de la pigmentation de la cavité abdominale chez les poulets de chair

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Coloured poultry is characterized not only by pigmentation of the feathers, but also by a certain degree of black pigmentation of the inner layer of the wall of the abdominal cavity.

In modern commercial broilers the incidence of abdominal black is usually very low, but in experimental crosses of broiler breeds a high incidence of pigmentation was in certain cases observed in spite of the white colour of the feathers.

The connection of plumage and shank colour with the deposition of black melanin in the abdomen was studied by JAAP (1955, 1958), HUNTSMAN *et al.* (1959, 1960) and KUIT (1967).

From these studies it has become clear that the relationship is not of a simple nature. Interactions of certain genes as well as incomplete dominance of alleles have been observed in the analysis.

Especially more attention was needed for the situation in commercial broilers, when both dominant and recessive white feathering appear in the heterozygous form: *Ii Cc*.

In the experiments at the Spelderholt Institute breeds of different origin were used, White Leghorn, Brown Leghorn, a blue shanked landrace, Barnevelder, White Cornish and White Plymouth Rocks.

Birds of different genotypes were killed at the age of 8 to 14 weeks. The amount of melanin in the abdomen was judged by visual inspection of the abdominal wall from the inside. An observational scale of five points was used:

0 — no melanin present
1 — trace of pigment
2 — moderately pigmented
3 — heavily pigmented, also clearly visible from the outside
4 — like 3 but pigment also present in the outer skin.

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The main results are listed in Table I, where the importance of the interaction of the alleles at the e^+ and *sd loci* as well as the influence of the white feather colour is demonstrated.

TABLE 1

DEGREE OF ABDOMINAL MELANIN DEPOSITION IN CHICKENS OF THE GENOTYPE *bl bl ss/s- IdId/Id-*

	$e^+ e^+$ *sd sd* *sd-*	$sd^B sd^B$ sd^B-	Ee^+ *sd sd* *sd-*	$sd^B sd^B$ sd^B-	*EE* *sd sd* *sd-*	$sd^B sd^B$ sd^B-
ii CC	0.4 1.1	1.4 1.8	1.9 2.6	0.1 0.4	2.4 2.7	0.3 1.1
ii Cc	0.4 1.1	1.3 2.1	1.5 2.2	0 0.7	2.3 2.7	0.8 1.3
ii cc	0.2 0.8	1.7 2.3	1.2 2.0	0 0.5	1.7 2.7	0.4 1.1
ii CC	0.4 1.1	1.4 1.8	1.9 2.6	0.1 0.4	2.4 2.7	0.3 1.1
Ii CC	0.1 0.5	1.0 1.2	0.2 0.5	0.1 0.1		
II CC	0 0.3	0.9 0.8				
Ii Cc	0 0.2	0.9 0.9	0.2 0.4	0.1 0.1		

The alleles involved are the following:

$E — e^+$, extended black versus restricted black of the wild-type pattern
$sd^B — sd$, sex-linked barring versus non barring
$C — c$, coloured versus recessive white
$I — i$, dominant white present or absent.

All birds were of the genotype *ss/s-* (gold), *bl bl* (no andalusian blue) and *Id Jd/Id-* (no melanic pigmentation of the shanks).

Results of the whole research project can be described as follows.

1. The incidence of black pigment in the abdominal wall is higher for females than for males when corresponding genotypes are considered.
2. No distinct differences were observed between breeds within colour types.
3. No difference or a non significant influence was observed for the alleles:
   $S — s$, silver versus gold
   $Bl — bl$, Andalusian blue
   $C — c$, coloured versus recessive white.
4. Appreciable inhibition of melanin deposition was found for
   $I — i$, dominant white versus coloured
   $Id — id$, uncoloured versus pigmented shanks.
   Both genes showed a high degree of dominance in their expression.

5. Interaction with a high degree of interdependence for the expression was found for the genes $E - e^+$, black versus wild colour, with the alleles of the barring *locus* of the sex chromosome $Sd - sd^B - sd$, sex-linked dilution — barring — non barring.
   In $e^+ e^+$ birds barring is a promoting and in Ee^+ and EE birds it is a reducing factor for melanin deposition.
6. The allele Sd of the barring *locus* is characterized by significant stimulation of the melanin deposition in the abdominal cavity.
   In correspondence with the action of barring the pigmentation is highest in wild-type birds.
7. The optimal genotype for broilers, assuring a very low incidence of melanin pigmentation, occurs when the regularly present *Ii Cc Id/Id-* is accompanied either by black (Ee^+) or by the combination of the wild-type pattern ($e^+ e^+$) without sex-linked barring.

SUMMARY

The genotype for feather- and shankcolour does not only define the exterior appearance of the bird, but also to a high extent the intensity of the pigmentation of the inner layer of the abdominal cavity. The interdependence of both characteristics is not of a simple nature in the sense of intensity of melanin deposition. Each colour-genotype has its own characteristic mean value for melanin deposition in the abdominal cavity wall.

Within a broilertype, originating from dominant and recessive white parents differences were observed which could be explained by assuming the presence of hypostatic genes in the genetic pattern.

RESUMEN

El genotipo para el color de pluma y tarsos no solamente define el aspecto exterior del ave, sino también, en gran extensión, la intensidad de la pigmentación de la pared interna de la cavidad abdominal. La interdependencia entre ambas características no es simple en el sentido de la intensidad de la deposición de melanina. Cada genotipo de color tiene su valor medio propio característico para la deposición de melanina en la pared abdominal.

En un tipo de *broilers*, originado a partir de padres con blanco dominante y recesivo, se observaron diferencias que podrían explicarse admitiendo la existencia de genes hipostáticos en la fórmula genotípica.

RESUME

La génotype pour la couleur du plumage et du tarse non seulement définе l'aspect extérieur du poulet, mais aussi en grande extension l'intensité de la pigmentation de la paroi interne de la cavité abdominale. Il existe une interdépendence non simple entre les deux caractéristiques, dans le sens de l'intensité

de la déposition de mélanine. Chaque génotype de couleur a sa valeur moyenne propre caractéristique pour cette déposition mélanique.

Chez un type de broiler obtenu à partir des reproducteurs ayant du blanc dominant et récessif, on a observé des différences qui pourraient être expliquées par l'existence des gènes hypostatiques dans la constitution génotypique.

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