

## NOTE ON A CHINCHILLA-JAPANESE CROSS IN RABBITS.

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(With One Text-figure.)

*Introduction.* Some experimental results obtained from the Japanese rabbit by Professor Castle and by myself<sup>1</sup> led us independently to the conclusion that the "Japanese" pattern could be regarded as a member of an allelomorphic series in which the other known terms are yellow<sup>2</sup>, recessive black, and dominant black. On this view of the genetical nature of the Japanese pattern it is assumed that the yellow there found associated with black is identical with the yellow of the various forms of yellow rabbits. It occurred to me that this assumption might readily be tested by examining the results of a cross between the Japanese and the chinchilla rabbit. Several years ago Castle showed that the chinchilla of the fancy may be regarded as an ordinary agouti from which the yellow colour is almost or quite absent. Where the banded hairs of an agouti are yellow they become silvery in the chinchilla, which perhaps ought more properly to be termed a silver agouti. The difference between an agouti and a chinchilla lies in the almost complete absence of the yellow, the melanic pigment being apparently unaffected. In the course of his work Castle "chinchillated" the yellow rabbit in the agouti series, which frequently contains little more than a trace of melanic pigment, and he found that such animals were almost pure white with the bluish smoky eye of the chinchilla<sup>3</sup>. Now if the yellow of the Japanese is of the same nature as the yellow of ordinary yellow rabbits we ought to be able to obtain from a cross between the chinchilla and the Japanese a form of the latter in which the black markings are on a white instead of on a yellow ground.

*Experimental Data.* A chinchilla doe (S 158) was obtained from a well-known breeder and mated at different times to two Japanese bucks of which one (S 68) was heterozygous for the agouti factor, while the

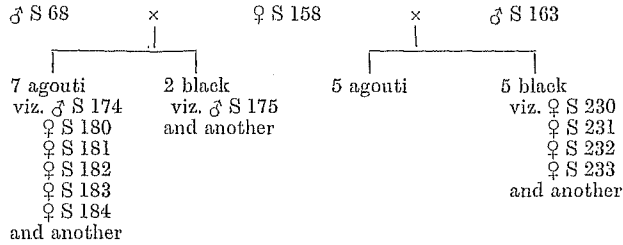
<sup>1</sup> *Journ. Genetics*, xiv. pp. 225-240.

<sup>2</sup> "Yellow" here is a general term comprising tortoise (=sooty yellow) as well as the yellow that contains the agouti factor.

<sup>3</sup> *Journ. Heredity*, xv. 1924.

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other (S 163) lacked it. As shown in the subjoined pedigree, she gave with the former buck 7 agoutis and 2 blacks, while from the other she produced 5 agoutis and 5 blacks, showing her to have been heterozygous for agouti.



The 5 agouti  $F_1$  does (S 180-184) were all mated with the black  $F_1$  ♂ S 175 to produce an  $F_2$  generation, while three of them (S 182-184) were also mated with the agouti  $F_1$  ♂ S 174. The results obtained are shown in Table I.

TABLE I.

	Agouti	Chin.-Ag.	Black	Chin.-black	Japanese	Wh. Jap.
♀ 180 × ♂ 175 (black)	6	2	4	2	4	—
♀ 181 × „	10	4	—	—	1	2
♀ 182 × „	3	1	2	1	—	—
♀ 183 × „	1	—	6	1	2	—
♀ 184 × „	4	4	4	—	3	2
	24	11	16	4	10	4
♀ 182 × ♂ 174 (ag.)	6	—	4	—	4	—
♀ 183 × „	4	1	—	1	1	—
♀ 184 × „	4	2	—	—	—	—
	14	3	4	1	5	—

As the table shows, six colour classes made their appearance, viz. the three classes agouti, black, and Japanese, together with the three corresponding forms in the chinchilla series. Of these the Japanese chinchilla was the most striking, and, as had been anticipated, was an animal with the characteristic black markings of the Japanese, but on a white instead of on a yellow ground (cf. Fig. 1).

The appearance of such animals leaves little doubt that the yellow of the Japanese rabbit is identical with that of the ordinary yellow rabbit.

The data in Table I also seem to show that the relation between the yellow-white, and the self-Japanese pairs of characters is a simple Mendelian one, *i.e.* that linkage does not enter into it. From this point of view the figures may be summarised as follows:

		<i>Exp.</i>
Yellow selfs (agoutis + blacks)	58	54
White selfs (chin.-agouti + chin.-blacks)	19	18
Yellow Japanese	15	18
White Japanese	4	6

There is a slight deficiency in the Japanese classes but the figures are sufficiently close to a 9 : 3 : 3 : 1 ratio to preclude the likelihood of any linkage between the characters concerned.

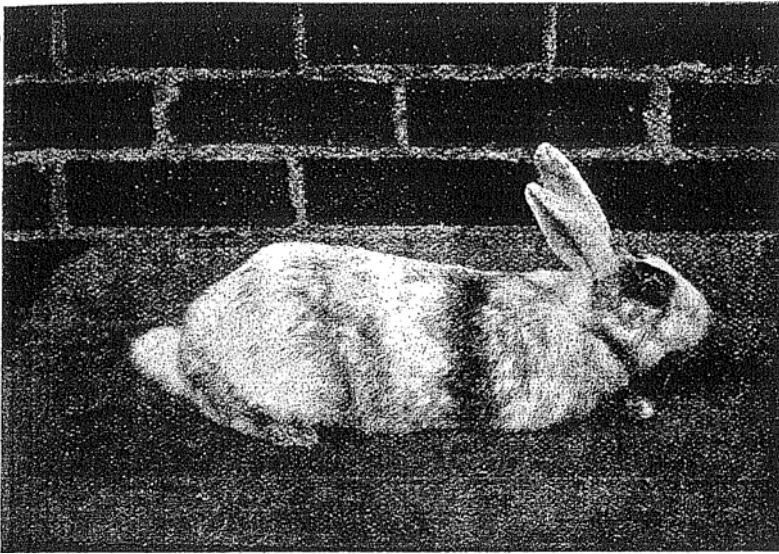


Fig. 1. White Japanese rabbit. From a photograph by M. S. Pease.

This view is confirmed by the results of a back cross made by mating the 4 black  $F_1$  ♀♀ (S 230-233) with a white Japanese  $F_2$  buck (S 187) as shown in Table II:

TABLE II.

	Agouti	Chin.-ag.	Black	Chin.black	Japanese	White Jap.
♀ 230 × ♂ 187	1	2	—	1	2	—
♀ 231 × „	—	1	2	1	2	—
♀ 232 × „	—	1	2	—	3	3
♀ 233 × „	—	—	—	—	3	3
<i>Exp.</i>	1	4	4	1	10	6
	3·4	3·4	3·4	3·4	6·8	6·8

The expected six classes appeared and, having regard to the paucity of numbers, in proportions not far removed from those expected.

We may conclude then (1) that the yellow of the Japanese is identical

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with the yellow of other rabbits, and (2) that there is no linkage between the yellow-white and the self-Japanese pairs of characters.

In conclusion, the chinchilla-black which appeared in these experiments calls for a few remarks. In coat colour this form was indistinguishable from an ordinary black. It was however recognised as belonging to the chinchilla series by its eye colour which, as development proceeded, showed the smoky blue tint characteristic of chinchillas in the black series (*i.e.* as opposed to chocolates) instead of the rich brown of a normal black. That the chinchilla-black is not necessarily of this type is clear from a recent publication of Castle<sup>1</sup> where he describes a form as in pigmentation "less heavy than that of an ordinary non-agouti black rabbit becoming in most parts of the body a dull, faded, brownish-black," though at the same time "the more intensely pigmented extremities may be described as black." In the same paper Castle also distinguishes between two forms of chinchilla-agouti, *viz.* a darker and a paler which he regards as allelomorphic to one another. It is clear from his work, as he points out, that the chinchilla form of black, or "sepia," bred by him corresponds to the paler type of chinchilla-agouti. The chinchilla-blacks that came in my experiments doubtless correspond to the darker type of chinchilla-agouti. Though variable in shade they were at about 10 days old much closer to the ordinary agouti than to the young pale type shown by Castle on Plate 3, fig. 1 *b*. Further, they often, though not always, showed some tinge of yellow in their first coat, especially on the back, a feature which Castle states is not found in the paler type, and is regarded by him as diagnostic of the darker.

I may add that this tinge of yellow in the baby coat is sometimes to be found in white Japanese, and in the case of one  $F_2$  ♂ (*viz.* S 213, ex ♀ S 181 × ♂ S 175) it was so marked that the animal was reared and mated back to the original chinchilla ♀ (S 158). Since he gave nothing but chinchilla young, 8 in all, there can be no doubt that he was a white Japanese. In this case the yellow tinge persisted after the baby coat was moulted, though it had nearly disappeared at the age of one year.

The cost of the experiments of which an account is given above was for the most part met by grants from the Government Grant Committee.

<sup>1</sup> Publ. No. 337 of the Carnegie Institution of Washington, 1926.