

18th. With the exception of one or two birds all of this group had yellow colored vents.

The data presented seems to indicate very strikingly a connection between the amount of yellow pigment showing in a hen and her previous, as well as her present, laying ability.

A fair assumption is that the body color fades out and the blood of high producing hens becomes thicker, as the writer, or in other words, contains shown by some recent investigations by more fat and cholesterol bodies than the blood of poor producing hens. The average amount of fat and cholesterol bodies found in high producing hens is 1.426% and in the low producing birds the average is .886%. This work is to be published elsewhere giving a full report of the methods used.

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SEX-LINKED INHERITANCE OF

The results of this experiment show clearly that the spangling pattern of the Silver Spangled Hamburg is inherited as a sex-linked character belonging to the Abraxas moth type, although the inheritance may be modified by the presence of disturbing factors.

Factors for black, inherited independently of spangling may obscure the spangling condition either on the entire body or on some definite portion of it. For example, black may effect the tail only, or may cover the entire body, as is seen in the case of the Females of the reciprocal crosses. The spangles themselves may be reduced in size by the spreading of the white background, until they become attenuated spots at the very tips of the feathers. In spite of these disturbances, the conclusion that there is a definite factor for spangling, which is sex-linked, seems entirely justified by the experimental results.

In this experiment the Silver Spangled Hamburg and the Brown Leghorn were used in the initial crosses. The Silver Spangled Hamburg has a characteristic black spangle at the tip of a white-based feather throughout the body in both sexes.

The experiments were undertaken for the purpose of determining, if possible, the mode of inheritance of this characteristic black spangling. In former experiments in which the Brown Leghorn has been used, no evidence has been obtained that this breed transmits spangling, and it is therefore, regarded as non-spangled.)

The males derived from reciprocal crossing were practically alike, having spangled bodies with black tails—with the exception of four individuals (three

in Mating No. 3 and one in Mating Number 4) which were entirely black. These black cocks later gave the same breeding results as their spangled brothers, and are evidently of the same genetic composition with respect to their ability to transmit spangling. The presence of multiple factors for black is probably responsible for the concealment of the spangled pattern of these birds. The daughters of the reciprocal crosses were strikingly different. Those from the Brown Leghorn male x Silver Spangled Hamburg female cross were black with various degrees of brown stippling on the wings, while from the crosses of the Silver Spangled Hamburg male x the Brown Leghorn female had peculiar greyish feathers, showing crescentic penciling with black and very distinct black spangles at the tip.

When the sires were spangled, the daughters were also spangled; if the father were non-spangled, his daughters had the same character. The daughters then, inherited the spangling from the father's side only. The breeding results are in accordance with the expectations.

Assuming that a factor for spangling is borne in the sex-chromosomes, the results are readily explained by the mode of transmission of these chromosomes. Neither of the sex-chromosomes of the Brown Leghorn cock carries the factor for spangling. The single sex-chromosome of the spangled female bears the spangled factor according to the hypothesis. The female will transmit the spangling to all the sons, but to none of the daughters, while the male will transmit spangling to neither sons nor daughters, because he does not carry the factor for spangling in either sex-chromosome. Thus, spangled males and non-spangled females are produced, the spangling acting as a dominant character in the heterozygous condition.

Contrasted with this, the Silver Spangled Hamburg male of the reciprocal cross, according to the hypothesis, should be homozygous for spangling as well as for sex. The Brown Leghorn hens being non-spangled, should not carry the factor for spangling in the sex-chromosome.

From such a mating it is obvious that only spangled males and females would result, for the father transmits the spangling to his sons and daughters alike, while the mother, being non-spangled, will not affect the result.

In the F₂ generation, true to expectations, all crosses followed the sex-linked mode of inheritance.

CONCLUSIONS.

1. The results are in accordance with the hypothesis that in poultry the male is homozygous for sex, and the female heterozygous; that the factors for cer-

tain characteristics are linked with the factors for sex.

2. Spangling in the Silver Spangled Hamburg follows the sex-linked mode of inheritance.

3. Spangling is inherited as a unit character independently of characters that are connected with different degrees of pigmentation.

4. Spangling is a unit character which segregates independently, and it may appear on the buff background inherited from the Brown Leghorn as well as on the white background of the Hamburg, as may be seen in different individuals of the F₂ generation. This would indicate the independent segregation of spangling as a definite unit.

5. The factor for spangling is independent of a factor or factors for mottling which seems to have a complicated form of inheritance.

6. The black cocks which transmit spangling, although adequate experimental data are lacking, would seem to be best explained by assuming the presence of multiple factors for black which may have a cumulative effect and conceal the spangled pattern.

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PRELIMINARY REPORT OF RESULTS OF AN EXPERIMENT ON CLOSE INBREEDING IN FOWLS.¹

It seems unnecessary at this time to review current ideas as to the effects of inbreeding. Briefly stated the consensus of present opinion seems to be that the continued mating of closely related individuals serves as a method of quickly fixing desirable traits in a breed, but that it also tends to accentuate faults, and commonly leads to deterioration of the stock, gauged by lowered fertility, weakened vitality and the like. Many practical experiments in inbreeding have been made by the breeder in his effort to improve his stock during the past several decades, and it is almost a truism that considerable inbreeding has been practiced in the establishing of practically every prominent breed of live stock. On the other hand, while they have not attracted such general attention, the failures have far exceeded the successes—so much so, in fact, that most breeders are afraid to practice very close breeding, preferring the slower but, in their opinion, safer method of hunting for animals with the desired traits in unrelated lines. According to common experience inbreeding is a sharp but double-edged tool.

Laboratory experiments likewise have

given conflicting results. In some cases inbreeding appears to have produced deterioration; in other experiments, particularly where proper selection has been practiced, no such effect has been noticed. While it may not be the whole story, the most probable cause of defects arising from inbreeding is that in the shuffling of factors in successive generations there is always the danger of loss of some which are of vital importance to the animal. On the other hand, since there is no crossing out with other stock there is no chance of replacing any such which may have been lost out of the germ plasm. The end result depends upon the effectiveness of conscious selection together with the chance results of the large amount of unconscious and uncontrolled selection which must occur, and this accounts for the inconstancy of results.

The experiment here briefly described was devised to eliminate one of these factors, namely conscious selection of any factors of vital importance to the subject. The plan has been to base the selection of individuals for carrying on the stock entirely upon a character which in no way, so far as we could judge, was associated with the animal's fertility or vitality. Rhode Island Red fowls were chosen as subjects for the experiment and plumage color as a basis of selection. The conduct of the experiment has been essentially as follows:

In February, 1913, twelve pullets from the University flock were placed in a pen with an entirely unrelated cockerel. The pullets varied in age from ten to eleven months and were more or less related, being descended from four hens and a cockerel used as foundation stock in 1910. The cockerel used was approximately eleven months old.

In following years, in order to carry on the experiment it was necessary to make a certain amount of selection on the basis of number of progeny, birds for this purpose being selected only from the progeny of single hens which had matured ten or more pullets and at least two cockerels during the season. Between these families, or fraternities, selection was now made on the following basis:

1. Individual pullets were judged on the basis of the color of the back, both surface and undercolor, "perfect" back color, according to the Standard of Perfection, being adjudged 100 and all pullets rated on this basis. In case of equality in back color, color of other parts was taken into consideration in prescribed order. No attention was paid to defects in other respects.

2. The ten highest scoring pullets were selected from each of the two lots ranking highest in the requirements of

¹Presented with the permission of the Director of the Wisconsin Agricultural Experiment Station.