THE RELATIONSHIP BETWEEN THE LENGTH OF THE OVIDUCT AND THE SIZE OF THE EGG

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Introduction

Several studies have been devoted to the relationship between the oviduct and the size of the egg by Curtis (1914), Asmundson (1931), Asmundson and Jervis (1933) and Harper and Marble (1945). According to these authors, the size of the egg was largely determined by parts of the magnum and the isthmus and partially by part of the uterus of the oviduct, but no relationship between lengths of any part of the oviduct and the size of the egg was observed.

On the otherhand, Mimura (1937) reported that there was the breed difference in length of the oviduct, which varied among the functional activity of a hen, as described by Romanoff and Romanoff (1949). It was expected from the breed difference that some relationships between the length of the ociduct and the size of the egg were observed in normal laying hens. Hens used in the experiment of the relationship between the length of the oviduct and the size of the egg were only Barred Plymouth Rock and further the size of the egg was usually expressed by the relative value of the shape index. The present paper dealt with the relationship between the length of the oviduct and the size of the egg, using White Leghorn hens and expressing the size of the egg by absolute values of its length and width, in addition to the shape index.

Materials and Methods

Hens used were two years old normal laying White Leghorn hens reared in the experimental farm of the authors' faculty. They were parts of hens used in the study on the sperm in the oviduct of the hens inseminated a few days before they were autopsied.

Lengths of the infundibulum, magnum, isthmus, uterus and vagina were measured. The total length and weight of the oviduct and also the body weight were measured. When a egg was found in a part of the oviduct at the time of autopsy, the measurement of the part was carried out after removal of the egg from the oviduct.

The data of the length, width, shape index and weight of the egg were based on last ten eggs laid before the hen was autopsied.

Results and Discussion

The length of each part of the oviduct and the total length of the oviduct were shown in Table 1. Following results were obtained from comparing these

results with those of one year old White Leghorn hens studied by Mimura (1937) and one year old Barred Plymouth Rock hens studied by Harper and Marble (1945).

Oviducts were almost equal in the total length for one year old White Leghorn hens and two years old ones. A significant difference in total length of the oviduct between Barred Plymouth Rock hens and White Leghorn hens was observed. Mimura (1937) observed a positive significant correlation between the total length of the oviduct and the body weight in the experiment with one year old White Leghorn hens. The body weight of Barred Plymouth Rock, quoted in Table 1,

Table 1. Lengths of the oviduct in hens.

Hens	Lengths of the oviduct (cm)					
	Total	Infundibulum	Magnum	Isthmus	Uterus	Vagina
White Leghorn (Two years old)	69.2±10.08 (100)	9.4±2.16 (13.6)	30.2±4.74 (43.6)	12.6±2.51 (18.2)	5.6±1.06 (8.1)	11.4±1.79 (16.5)
White Leghorn* (One year old)	68.2 (100)	10.2 (14.9)	31.5 (46.4)	9.8 (14.4)	7.1 (10.4)	9.6 (14.1)
Barred Plymouth Rock** (One year old)	76.3 (100)	12.6 (16.6)	34.8 (45.6)	16.4 (21.5)	5.2 (6.8)	7.3 (9.6)

* Cited from Mimura (1937).

** Cited from Harper and Marble (1945).

The figures in the parenthena show the relative values (%).

was not known, but a considerable difference in body weight seemed to be found to exist between these two breeds of hens. It seemed likely that the breed difference in total length of the oviduct corresponded with that in body weight, although there was no significant correlation between the body weight and the total weight or the total length of the oviduct in two years old White Leghorn hens.

The length of part of the oviduct was closely related with its total length. The breed difference in length of part of the oviduct, therefore, might be accounted for the difference in total length or the difference in body weight. Thus, in order to examine the difference in length of part of the oviduct between the two breeds of hens, the relative value of the length and the length corrected for the total length were used. No difference in length of the infundibulum or the magnum was found among three groups of hens. The relative length of the isthmus of one year old White Leghorn hens, two years old White Leghorn hens and Barred Plymouth Rock hens were 21.5, 18.2 and 14.4, respectively. Moreover, there was a significant difference in corrected length of the isthmus between Barred Plymouth Rock hens and two years old White Leghorn hens. It was indicated from these results that the isthmus part of Barred Plymouth Rock hens was longer than that of White Leghorn hens, and that the isthmus part of two years old hens was longer than that of one year old hens in White Leghorn.

Conversely, the relative length of the uterus of one year old White Leghorn hens, two years old White Leghorn hens and Barred Plymouth Rock hens were 10.4, 8.1 and 6.8, respectively. The difference in corrected length of the uterus between Barred Plymouth Rock hens and two years old White Leghorn hens was not significant statistically.

Although the weights of the egg of two groups of hens quoted in Table 1 were not known, it was described that the egg of Barred Plymouth Rock hens was bigger than that of White Leghorn hens by Farnswoth and Nordskog (1955) and that the egg of two years old hens was bigger than that of one year old hens by Clark (1940). On the otherhand it was suggested in the experiment, as mentioned later, that the width of the egg was determined by the length of the isthmus part of the oviduct and that the width of the egg was more highly correlated with the weight of the egg than the length of the egg was, in agreement with results of Asmundson (1931) and Hicks (1958). It therefore appeared that the possibility of laying a longer width egg or a bigger egg was due to a longer isthmus part of hen's oviduct. The relative length of vagina of two years old White Leghorn hens, one year old White Leghorn hens and Berred Plymouth Rock hens were 16.5, 14.1 and 9.6

Table 2. Coefficients of correlation between lengths of the oviduct and and sizes of the egg.

Sizes of egg	Infundibulum	Magnum	Isthmus	Uterus	Vagina
Weight	−.338	.180	.313	−.349	.242
Shape index	−.117	.049	.101	−.080	.108
Length	−.146	.180	.230	−.017	.162
Width	−.300	.175	.358*	−.369*	.242

* Significant at the 5% level.

Table 2 included coefficients of correlation between lengths of the oviduct and sizes of the egg. There were negative correlations between sizes of egg and the length of the infundibulum, or the length of the uterus, but positive correlations between sizes of the egg and the length of the magnum, the length of the isthmus, or the length of the vagina. Significant coefficients of correlation, however, were found between the width of the egg and the length of isthmus ($r=0.358$), and between the width of the egg and the length of the uterus ($r=-0.369$). These relationships were in agreement with results obtained from the breed difference in length of isthmus or uterus. It was clear from these results that the increase in width of the egg was influenced by the increase in length of the isthmus or the decrease in length of the uterus of the hen's oviduct. To account for this fact, it might be considered that the force applied to the egg, passing through the longer isthmus, by the contraction of the isthmus musculature, as described by Harper and Marble (1945), would be milder to increase the width of

the egg in a hen.

It was suggested that the shorter width egg was due to the longer uterus in the experiment but the reason was not clear. Correlations between the egg shape index and lengths of any parts of the oviduct were not significant. This seemed to be due to that the egg shape index which was obtained by dividing the width of the egg by its length and multiplying the result by 100 was a relative value for the size of the egg, as suggested by Baker (1960).

Summary

The relationship between the length of each part of the oviduct and the size of the egg was studied using two years old hens of White Leghorn.

There was a positive significant correlation between the length of the isthmus of the oviduct and the width of the egg, indicating the increase in width of the egg was corresponded to the increase in length of the isthmus. It seemed to be concluded that the longer width of the egg was due to the milder ccntraction of the muscle of the isthmus while the egg passed through the isthmus.

It was indicated in comparing the result of the length of the isthmus with that of other groups of hens that the egg was heavier in the group of the hen with the longer isthmus. It seemed likely that the difference in width of the egg due to the difference in length of the isthmus was confirmed in the results of the difference in weight of the egg.

There was a negative significant correlation between the length of the uterus and the width of the egg. No significant correlation was observed between lengths of any other parts of the oviduct and the egg weight, the egg shape index or the length of the egg.

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鶏の輸卵管の長さと卵の大きさとの関係

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要 約

鶏の輸卵管の長さと卵の大きさとの関係を白色レグホーン2年鶏を用いて調べた。

その結果，輸卵管峡部の長さと卵短径との間に正の相関々係があり，峡部の長さが長くなると卵短径が長くなることがわかつた。これは峡部が長くなると，峡部を通過する卵に加わわる筋肉の収縮が弱わまるためであろうと考えた。なお，峡部の長さを他の鶏群の結果と比較すると，峡部の長さの長い鶏群が卵重も大であり，これも峡部の長さが長いものが卵短径の長い卵を産出するためと思われた。

輸卵管子宮部の長さと卵短径との間には，負の相関々係が認められたが，輸卵管のどの部位とも卵重，卵型指数および卵長径との間には有意の相関々係は認められなかつた。